From:	Wendy Loya
To:	Steve Berendzen; Joanna Fox; Doug Damberg; Mitch Ellis; Socheata Lor; Mary Colligan; Patrick Lemons; Eric Taylor; Richard Lanctot; Carl Johnson; Joshua Ream; Andrea Medeiros; Sara Boario; Stephanie Brady; Tracy Fischbach; John Trawicki; John Martin; Drew Crane; Greg Siekaniec; Karen Clark
Cc:	Greta Burkart; Joshua Rose; Angela Matz; Paul Leonard; Randy Brown; Hollis Twitchell; Edward Decleva; Stephen Arthur; Christopher Latty; Ryan Wilson; Christopher Putnam; Peter Butteri; Ted Swem; Louise Smith; Jennifer Reed; Alfredo Soto; Susan LaKomski; Roger Kaye; Patrick O"Dell; Tamara McCandless; Tim Allen; Catherine Collins; Jill Webster
Subject:	Link to combined 1002 Area Resource Assessments (02/18) and FWS Select Bibliography PDF
Date:	Tuesday, May 1, 2018 3:19:30 PM

Dear Colleagues,

A link to a PDF that combines the 1002 Area Rapid-Response Resource Assessments and FWS Select Bibliography can be found at this link:
https://drive.google.com/file/d/1_124q-WQ6QnPehIZa84yENIxM4UPnzp-/view?usp=sharing

or you can find it in the R7 Common Drive>Working>Resource Assessments_Originals.

The Resource Assessments have been a valuable resource for guiding 2018 funding priorities and will continue to inform us as we do further science planning for 2019 and beyond. We will share the combined document with BLM and the Coastal Plain EIS contractor as well.

Thank you all for the effort that went into these documents, they are a great start,
Wendy

Dr. Wendy M. Loya, Coordinator
Office of Science Applications -Arctic Program
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

Rapid- Response Resource Assessments and select References for the 1002 Area of the Arctic National Wildlife Refuge in anticipation of an Oil and Gas Exploration, Leasing and Development Program per the Tax Act of 2017 Title II Sec 20001

Prepared by the Alaska Regions of the
US Fish and Wildlife Service and Bureau of Land Management

February 16, 2018

Following the passage of the Tax Act of 2017, the US Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM) and other federal and state agencies organized to evaluate the possible types of decisions that might need to be made to successfully implement an oil and gas program in the 1002 Area of the Arctic National Wildlife Refuge (Coastal Plain). A lead expert from FWS or BLM lead the development of a document (Rapid Response Resource Assessment) that identified i) regulatory or management related decisions that may have to be made, ii) what information is available to support that decision making, iii) possible knowledge gaps and iv) recommended studies or actions to fill any knowledge gaps or improve the best available science. The FWS used the results of the recommended studies or actions sections to help guide funding for FY 2018 towards projects that would be useful for improving future regulatory decision making, mitigating the impacts of seismic exploration and establishing contemporary pre-development baseline data.

The Rapid-Response Resource Assessments capture the results of this effort. The Resource Assessments are not to be considered comprehensive, complete or final, and recommended studies or actions may be added or removed over time as FWS has an increased understanding of how an oil and gas program will be implemented on the 1002 Area of the Coastal Plain and with increased awareness of existing information.

A bibliography of select manuscripts, reports and other publications authored by past and present FWS employees is included. It is not intended to be comprehensive of all research in the 1002 Area of the Coastal Plain.

Discipline/Subject Area: Acoustic Environment

Lead facilitator: Mark Miller, Deputy Director, BLM / North Slope Science Initiative, memiller@blm.gov, 907-271-3212

Individuals contacted for subject-matter expertise:

- Todd Atwood (Research Wildlife Biologist, USGS Alaska Science Center; tatwood@usgs.gov, 907-786-7093)
- Davyd Betchkal (Biologist/Soundscape Specialist, NPS Natural Sounds and Night Skies Division; davyd_betchkal@nps.gov, 907-683-5754)
- Tracy Fischbach (Natural Resources Planner, National Wildlife Refuge System – Region 7; tracy_fischbach@fws.gov, 907-786-3369)
- Tracey Fritz (Anthropologist, BLM Arctic District; sfritz@blm.gov, 907-474-2309)
- Randy Goodwin (Outdoor Recreation Planner, BLM Alaska State Office; rgoodwin@blm.gov, 907-474-2369)
- Roger Kaye (Wilderness Coordinator, USFWS Region 7; roger_kaye@fws.gov, 907-456-0405)
- David Payer (Regional Wildlife Biologist, NPS Alaska Region; david_payer@nps.gov, 907-644-3578)
- Alan Peck (Soil, Water, Air Program Lead, BLM Alaska State Office; kpeck@blm.gov, 907-271-4411)
- Alfredo Soto (Wildlife Refuge Specialist, USFWS Arctic National Wildlife Refuge; alfredo_soto@fws.gov, 907-456-0303)
- Hollis Twitchell (Assistant Manager, USFWS Arctic National Wildlife Refuge; hollis_twitchell@fws.gov, 907-456-0512)

What do we need to know and why regarding subjects? Decisions to issue oil and gas leases and to permit development-related activities will indirectly or directly result in the generation of noise (i.e., unwanted sound) that has the potential to impact the acoustic environment and noise-sensitive resources within and adjoining the 1002 Area. Gravel mining (blasting), drilling, and aircraft operations generally produce the highest levels of noise and have the potential to be audible above natural ambient sound levels and disruptive to noise-sensitive resources up to many miles from the noise source, depending on several factors that affect noise propagation and attenuation.

Noise-sensitive resources within and adjoining the 1002 Area include:

- **Wildlife** such as caribou, polar bears, musk ox, and numerous bird species, many of which are important subsistence resources for rural residents;

- **Residents** of Kaktovik, including those engaged in subsistence activities on the coastal plain beyond the village itself;

- **Visitors** to the coastal plain; and

- **Visitors and wilderness values** in congressionally designated Wilderness that borders the coastal plain to the south and east, including opportunities to experience solitude (i.e., the absence of distractions from mechanization, noise, and unnatural light).

Several types of information are needed to understand, assess, and disclose potential impacts on the acoustic environment and noise-sensitive resources, and to provide a basis for decisions about lease stipulations and permit conditions necessary for avoiding, minimizing, or mitigating impacts to the extent possible. (For specific details regarding information needs for noise-sensitive resources themselves, see other sections that address polar bears, caribou, birds, subsistence activities and values, visitors and recreation, and wilderness values.) These information needs include:

- **Baseline (pre-development) acoustic conditions**, including natural ambient sound levels and characteristics of baseline noise conditions such as magnitude, timing, duration, and frequency of occurrence of noise events. The metrics used for characterizing baseline conditions should be those that are most relevant to impact assessment and mitigation, and may vary among different types of noise-sensitive resources. For example, metrics that characterize the frequency and duration of abrupt noise events loud enough to trigger disturbance responses in wildlife and metrics that characterize average hourly noise levels both may be important for describing baseline conditions. Baseline data are required for those specific time periods and specific geographic locations when and where noise from proposed development activities is expected to coincide with periods and locations of high resource sensitivity, considering factors that affect noise propagation and attenuation. Periods and locations of particularly high resource sensitivity may include those associated with:

    - Polar bear denning activities;
    - Caribou calving and post-calving activities;
    - Migratory bird breeding and brood-rearing activities;
    - Kaktovik (all periods of occupancy);
    - Subsistence activities beyond Kaktovik;
    - Visitor use on the coastal plain; and
    - Visitor use in designated Wilderness adjoining the 1002 Area.

- **Acoustic characteristics of specific development-related noise sources**, including typical and maximum magnitude, timing, duration, and number of occurrences during time periods relevant to impact analysis and mitigation (analogous to an air emissions inventory necessary for predictive modeling of development-related impacts on air quality and air quality related values). One-third octave band frequency resolution is preferred.

- **Modeled spatial predictions of acoustic impacts** attributable to development-related noise sources (i.e., noise propagation modeling.) Spatial noise propagation modeling is required for the purpose of estimating how development-related noise would be expected to propagate and potentially impact noise-sensitive resources depending on factors such as noise magnitude, distance

from the noise source, ambient sound levels, atmospheric conditions, and landscape characteristics.

- **Disturbance-response information** that quantitatively or qualitatively characterizes relationships between noise metrics and response metrics for noise-sensitive resources including wildlife, residents and subsistence users, and Refuge visitors on the coastal plain and in adjoining Wilderness. This information is necessary for assessing, disclosing, avoiding, minimizing, and mitigating potential noise impacts to the extent possible.

  The degree to which noise disturbs and impacts wildlife and people is dependent on many factors. Wildlife responses to noise are known to vary by species, and depend on acoustic factors including the frequency, intensity / magnitude (loudness), and duration of noise; as well as on non-acoustic factors including life-history stage, environmental or behavioral context, and degree of past exposure (Francis and Barber 2013). Noise that is chronic may impact sensory capabilities via masking of biologically important natural sounds such as those used for communication or detection of predators or prey. Noise that is intense and abrupt (therefore unpredictable) may be perceived as a predation threat by prey species such as caribou, potentially triggering a startle response or antipredator behavior such as fleeing. In these cases, the type of disturbance response also may be contingent on whether the noise stimulus is accompanied by an abrupt and threatening visual stimulus, as can be the case with noise events associated with low-flying aircraft.

  As with wildlife, human responses to noise also are contingent both on acoustic and non-acoustic factors. Among the non-acoustic factors are social context and perceived ability to exert control over the noise source (Stallen 1999).

  The special case of aircraft disturbance. Disturbance of subsistence resources (particularly caribou) and subsistence activities by low-flying aircraft associated with oil and gas development has long been an issue of concern to North Slope residents (e.g., see Brown 1979, pp. 38-39). The level of concern has increased over time as use of aircraft to support research and monitoring, recreation, oil and gas development, and other activities on the North Slope has increased during the past few decades.

  Aircraft disturbance of subsistence resources and activities is an issue that involves noise, but is one that is not solely attributable to acoustic factors. Relevant non-acoustic factors include all of those listed above for wildlife and for people. Because of the importance of non-acoustic factors, potential impacts of development-related noise on subsistence resources and activities cannot be assessed only on the basis of acoustic metrics and must be considered in relation to non-acoustic factors as well. For example, BLM staff have noted that subsistence hunters' concern with aircraft disturbance in and near NPR-A is affected by the high degree of uncertainty and unpredictability about where aircraft will be, and therefore by hunters' inability to foresee and avoid aircraft disturbance when engaged in subsistence pursuits (BLM 2017). The spatial unpredictability of aircraft disturbance contrasts with other development-related

disturbances that are predictably associated with gravel roads, pads, and other forms of fixed infrastructure.

The information needed to address this issue is a rigorous, interdisciplinary understanding of the effects of aircraft disturbance (including acoustic factors and contextual non-acoustic factors) on subsistence resources, users, and activities.

- **Long-term acoustic monitoring** to determine actual development-related impacts on the acoustic environment, determine the need for noise-mitigation measures, evaluate the effectiveness of such measures following implementation, and support adaptive management.

What information is currently available to address the information needs for subjects?

- **Baseline acoustic conditions**. During 2010, short-term baseline acoustic data were collected at two sites (Canning River West Bank and Brownlow Spit) in the extreme northwest corner of 1002 Area in support of the Environmental Impact Statement (EIS) for the Point Thomson project (see USACE 2012, Appendix O, Noise Technical Report). Relevant baseline data also were collected at a third site (Coastal Plain) located approximately 2 mi (3.2 km) west of the 1002 Area. In a study conducted in the NPR-A rather than the 1002 Area, Stinchcomb (2017) demonstrated methods for collecting baseline acoustic data, focusing on baseline characterization of aircraft noise events and noise-free-intervals in relation to subsistence resources and activities.

- **Acoustic characteristics of specific development-related noise sources**. Typical noise levels generated by individual pieces of construction equipment and specific construction operations are available online from the U.S. Department of Transportation Federal Highway Administration (USDOT 2006). Recent noise levels for common gas field activities (including active drilling operations) are reported by Ambrose and Florian (2014) based on field data collected in 2013 at locations near the Pinedale Anticline Project Area in Wyoming.

  Noise levels generated by different types of aircraft during different phases of flight operations are available from the Federal Aviation Administration's (FAA's) Aviation Environmental Design Tool (AEDT, https://aedt.faa.gov/), a software system that models aircraft performance for the purpose of estimating emissions, noise, and fuel consumption. Aircraft noise data extracted from the FAA model, previous versions of the model, or similar sources also can be found in a number of publications. Examples include data for a Bell 206 helicopter, a Cessna 207, and a de Havilland DHC-6 Twin Otter (Miller et al. 2003); and a C-130 cargo aircraft (USACE 2004, Appendix H).

- **Modeled spatial predictions of acoustic impacts**. Currently there is no spatial noise propagation information that is specific to anticipated activities, landscape characteristics, and noise-sensitive resources in and adjoining the 1002 Area, although methods used for the Point Thomson EIS are relevant (see USACE

2012, Appendix O; note that aircraft noise propagation was modeled using an FAA model that has since been replaced by the AEDT). Lacking time and technical capacity for spatial noise propagation modeling, BLM (2018) estimated propagation distances for development-related noise by assuming that noise levels would attenuate by 6 dBA for each doubling of distance from the source (Attenborough 2014). This estimation method does not account for potential effects of meteorological conditions, sound barriers, and landscape characteristics on noise propagation and attenuation.

- **Disturbance-response information**. For noise-sensitive resources in and adjoining the 1002 Area, information that relates specific disturbance responses to specific noise metrics are lacking, but several general sources of pertinent information are available. General reviews on the topic of noise disturbance on wildlife include Pepper et al. (2003), Pater et al. (2009), and Shannon et al. (2015). Frid and Dill (2002) and Francis and Barber (2013) provide theoretical frameworks for understanding noise impacts on wildlife, and risk-assessment frameworks for evaluating low-altitude aircraft impacts are provided by Efroymson and Suter (2001) and Efroymson et al. (2001). Stallen (1999) provides a theoretical framework for considering human annoyance with noise.

  Information sources with greater direct relevance to 1002 Area resources include the literature review prepared by Anderson (2007) and several specific papers on caribou responses to low-flying aircraft including Calef et al. (1976), Valkenburg and Davis (1983), and Harrington and Veitch (1991). Murphy et al. (1993; Maier et al. 1998 is the same study) investigated effects of low-altitude military jet aircraft on the Delta Caribou Herd and is the only work that includes actual noise-level data. Lawler et al. (2005) examined effects of low-altitude military jet overflights on the Fortymile Caribou Herd, focusing on the calving season.

  Blix and Lentfer (1992) measured noise and vibration levels resulting from seismic testing, drilling, and transport (including helicopters) in artificial polar bear dens in Prudhoe Bay and concluded that "…the dry and wind-beaten arctic snow muffles both sound and vibrations extremely well and it seems unlikely that polar bears in their dens will be disturbed by the type of petroleum-related activities measured here, providing those activities do not take place within 100 m of the den." But there remains a lack of information about noise levels that are most likely to cause bears to abandon dens, and variation among individual bears also is a factor. There have been instances in which bears have denned immediately adjacent to industrial infrastructure and stayed in the den for the full term. There also have been instances in which dens were abandoned early due to nearby disturbances such as ice-road construction (T. Atwood, pers. comm., 2/13/2018).

  On the topic of aircraft disturbance of subsistence activities, Stinchcomb (2017) concluded on the basis of a meta-analysis of published literature that "…no peer-reviewed literature has addressed the conflict between low-flying aircraft and traditional harvesters in Arctic Alaska" despite extensive evidence that such conflicts are widespread. She speculated that "…the scale over which aircraft, rural communities, and wildlife interact limits scientists' ability to determine causal

relationships and therefore detracts from their interest in researching the human dimension of this social-ecological system."

Christensen and Christensen (2009) reported results of surveys conducted to determine experiences and preferences of visitors to the Arctic Refuge. Although no survey questions addressed the issue of noise *per se*, several questions addressed visitor experiences of and preferences for aircraft use for particular types of activities.

In addition to the Point Thomson EIS and the forthcoming BLM Supplemental EIS for the GMT-2 project, other relevant information sources include impact analyses, stipulations, and best management practices included in the Integrated Activity Plan (IAP) for NPR-A (BLM 2013). Although the IAP did not address noise as a specific issue topic, noise was a factor considered in analyses conducted for several topics related to wildlife and subsistence. The Record of Decision (ROD) for the IAP includes several specific requirements for permitted aviation activities (see Best Management Practice F1, ROD pp. 65-67; also see BLM 2017) that are intended to avoid, minimize, or mitigate aircraft disturbances on wildlife and subsistence activities. These include spatial and seasonal buffers, in addition to minimum flight altitudes (contingent on flight safety considerations).

- **Long-term acoustic monitoring**. No long-term monitoring has been established in the 1002 Area for the purpose of detecting future changes in acoustic conditions and attributing such changes to particular activities including those associated with oil and gas exploration and development.

What are key information gaps?

- **Baseline acoustic conditions**. Baseline acoustic data for the 1002 Area are completely lacking, with the exception of short-term data collected in the extreme northwest corner of 1002 Area in support of the Point Thomson EIS (USACE 2012). Baseline data provide a foundation for long-term monitoring that will be required to support impact mitigation and adaptive management.

- **Acoustic characteristics of specific development-related noise sources**. Although some general acoustic information is available, impact assessment and mitigation actions would benefit from specific acoustic information associated with specific development activities that are anticipated or proposed for the 1002 Area. Such information is analogous to emissions inventory data that are used to support impact analyses and mitigation requirements for air quality and air quality related values.

- **Modeled spatial predictions of acoustic impacts**. Spatial noise propagation modeling that specifically applies to anticipated / proposed development activities and specific landscape characteristics and seasonal atmospheric conditions of the 1002 Area is lacking.

- **Disturbance-response information**. Although much general information is available, specific disturbance-response information is needed to quantitatively or

qualitatively characterize relationships between noise metrics and response metrics for noise-sensitive resources including wildlife (especially caribou and polar bears), residents and subsistence users, and Refuge visitors on the coastal plain and in adjoining Wilderness.

- **Long-term acoustic monitoring**. To support impact mitigation and adaptive management, long-term acoustic monitoring should be established early during the phased progression of development activities. Baseline data and long-term monitoring are required for those specific geographic locations and specific time periods where and when anticipated / proposed development activities are expected to coincide with high resource sensitivity. Note that long-term monitoring also is lacking in the BLM-administered NPR-A and the nearby village of Nuiqsut despite public concerns over impacts of aircraft disturbance and development-related noise on village residents, subsistence resources, and subsistence activities. This lack of monitoring information has relevance to the 1002 Area, if BLM Best Management Practice F-1 (BLM 2013) is to be considered for application to future development activities in the 1002 Area.

In addition to key information gaps, both BLM and USFWS have significant gaps in the subject matter expertise necessary for credibly and effectively assessing and mitigating impacts of development-related noise on noise-sensitive resources of the 1002 Area.

What studies/surveys need to be conducted to fill those information gaps?

- **Baseline acoustic conditions** should be quantified for those specific geographic locations and time periods where and when anticipated / proposed development activities are expected to coincide with high resource sensitivity (see list above under **What we Need to Know and Why**). Costs will be contingent on the scope of the data collection effort necessary for accurately characterizing baseline acoustic conditions for key locations and time periods. Design parameters such as the number and locations of monitoring sites, and the timing and duration of data collection should be determined jointly by subject matter specialists with expertise in anticipated development activities, specific noise-sensitive resources, and acoustic monitoring and analysis. Based on past work experience, contractors with appropriate acoustic expertise may include HDR Alaska Inc. (contractor for the Point Thomson EIS, including acoustic work), and HMMH, Inc. (a firm with specialized experience in acoustics and Federal projects).

- **Acoustic characteristics of specific development-related noise sources** should be determined through direct measurements of analog noise sources or should be provided by project proponents in the form of a noise emissions inventory for each phase of development.

- **Modeled spatial predictions of acoustic impacts** should be conducted for purposes of impact assessment, disclosure, and mitigation associated with proposed development activities.

- **Disturbance-response research** should be conducted to satisfy specific information needs for understanding, assessing, disclosing, and mitigating impacts of development-related noise on noise-sensitive resources. Priorities for this type of research should be identified in collaboration with subject matter experts for specific noise-sensitive resources.

- **Long-term acoustic monitoring** should be designed and implemented by BLM or USFWS staff (or appropriate cooperators / contractors) with expertise on the topics of acoustic engineering and environmental monitoring. This should be done in close collaboration with subject matter experts for specific noise-sensitive resources. As noted above, long-term acoustic monitoring (or the lack thereof) in NPR-A has potential implications for development planning and impact mitigation in the 1002 Area. Although recent work by Stinchcomb (2017) provides important baseline acoustic data for NPR-A, further acoustic research and monitoring is warranted to determine the effectiveness of Best Management Practice F1 (BLM 2013, pp. 65-67) and aid in evaluating whether alternative or additional practices may be required to minimize effects of low-flying aircraft on subsistence resources, activities, and residents of Kaktovik as phases of oil and gas development progress in the 1002 Area.

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REPORTING TEMPLATE: Air Quality Monitoring and Analysis

Lead facilitator:

Dr. Angela Matz, Environmental Contaminants Specialist, U.S. Fish and Wildlife Service, angela_matz@fws.gov, 907-271-2778, 907-750-8527 (cell)

Individuals contacted:

- Tamara McCandless, FWS, Chief, Branch of Air and Water Resources, tamara_mccandless@fws.gov
- Catherine Collins, FWS, Environmental Engineer, Branch of Air and Water Resources, catherine_collins@fws.gov, 303-914-3807
- Tim Allen, FWS Branch of Air and Water Resources, tim_allen@fws.gov, 303-914-3802
- David Maxwell, BLM National Operations Center, dmaxwell@blm.gov, (303) 236-0489
- Craig Nicholls, BLM National Operations Center, cnicholl@blm.gov, (303) 236-9508
- Alan Peck, Soil, Water and Air Program Lead, BLM Alaska State Office, kpeck@blm.gov, (907) 271-4411
- William Simpson, Department of Chemistry & Biochemistry, University of Alaska Fairbanks, 907.474.7235, wrsimpson@alaska.edu
- Deanna Huff, ADEC-Air Quality, 907-465-5116, deanna.huff@alaska.gov

What do we need to know and why regarding Air Quality Monitoring and Analysis?

- Air Quality (AQ) and Air Quality Related Values (AQRV) analyses will be required for oil and gas exploration and development in the 1002 Area of the Arctic National Wildlife Refuge (NWR).

- The **legal basis** for performing AQ and AQRV analyses for industrial activities that may affect federal lands and for operating in the Arctic NWR come from:
    - Clean Air Act (CAA),
    - National Environmental Protection Act (NEPA),
    - Federal Land Policy Management Act (FLPMA),
    - Refuge Improvement Act and the Wilderness Act,
    - Alaska National Interest Lands Conservation Act (ANILCA), and
    - Arctic NWR Comprehensive Conservation Plan (CCP).

- **Guidance and Policy** regarding AQ and AQRV analysis can be found in the:
    - Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report—Revised (2010), and
    - Memorandum of Understanding among the U.S. Department of Agriculture, U.S. Department of the Interior, and U.S. Environmental Protection Agency, Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the National Environmental Policy Act Process (June 23, 2011).

- **Sensitive resources:** The Arctic Refuge 1002 area is at the eastern end of the Arctic Coastal Plain, and therefore has similar resources to the NPR-A e.g., lichens and moss, which are important caribou forage during winter and migration. Lichens and moss are particularly sensitive to air pollution. Additionally, the Arctic Refuge coastal plain has:

- Adjacent designated Wilderness which could be degraded by exploration and development activities;
- Prevailing NE winds that place it upwind of other Dept. of Interior land management areas, particularly Gates of the Arctic National Park and Preserve;
- Fish and wildlife resources used for subsistence, including berries, fish, and migratory birds, that may be affected by airborne pollutants;
- Denning and feeding ESA- and MMPA-protected polar bears, which have demonstrated contaminant loads and may be susceptible to impacts from additional airborne contaminants.

- Interested stakeholders for oil and gas development in the Arctic Refuge include subsistence users, hunters and fishers, river and trekking guides, and the nation's public, who may conclude that oil and gas development in the Arctic 1002 area would permanently and irreversibly disrupt the ecological integrity. This interest may initiate litigation.

- Based on legislation, the maximum extent of surface development footprint is known. Construction and operation activity related to that footprint can reasonably and should be identified.

- AQ and AQRV analyses quantify:
  - Criteria Pollutants (for National and Alaska Ambient Air Quality Standards; NAAQS and AAAQS) Carbon Monoxide (CO), Ozone (O_3), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Particulate Matter (PM_{10}, and $PM_{2.5}$), Lead;
  - Air Quality Related Values (AQRVs) – impact to visibility and Nitrogen & Sulfur deposition;
  - Air Toxics (Benzene, Formaldehyde, etc.);
  - Greenhouse Gases (GHGs; Carbon Dioxide [CO_2], Methane [CH_4], etc.); and
  - Ultra-fine particulates and Black Carbon (Soot), which are related to changing albedo ("graying" of the Arctic).

- AQ and AQRV analyses are cumulative over the life of a project, so below we discuss Information Needs for three phases:
  - Phase 1: Information needed to develop an Integrated Activity Plan and a lease sale within one year;
  - Phase 2: Information needed for subsequent NEPA processes leading to drilling and production; and,
  - Phase 3: Information needed to protect resources as further exploration, drilling, and production programs proceed.

  For all phases, **information needed** to conduct AQ and AQRV analyses include:
  - Detailed **project descriptions**.
  - **Analysis of current data** sufficiency and evaluation of the need for **additional data collection**, as adequate ambient background concentration data do not exist.
  - Air quality modeling (AQ and AQRV) **modeling and result interpretation**.
  - **Incorporation** of AQ and AQRV results **into the NEPA process**.

Information Needs (by Phase)

Phase 1. Information needed to develop an Integrated Activity Plan (IAP) and a lease sale within one year:

- Key project description elements for seismic exploration or exploratory drilling:
  - Aircraft Information (number, type of planes; number of Landing/Takeoffs(LTOs))
  - Camp Facilities (Camp water maker, heaters, etc.)
  - Fuel Supply and storage
  - Size of operation (e.g., cat train versus drilling rig)

- Adequate data substitutes for background National Ambient Air Quality Standards (NAAQS) and Hazardous Air Pollutant Standards (HAPS) concentrations (no local ambient air quality data exists and could not be collected within one year).

  Especially true for background NO_2 for subsistence hunting, trapping and fishing access.

  - Past modeling efforts in Alaska have found that 1-hour NO_2 emissions can be significant around large drill rigs (e.g. 5 km radius buffer). The 1-hour NO_2 standard was established by the Environmental Protection Agency (EPA) to protect human health. An example of the process (not the data) is previous work on the Kenai NWR.

  - There is also a drill rig workgroup for NO_2 impacts to the Arctic with respect to permitting (http://dec.alaska.gov/air/ap/docs/North-Slope-POGO-Simulation-Modeling-Report-FINAL-2017-10-17.pdf)

- Modeling, interpretation, and review could take 1 week to 1 month depending upon the geographic area, nearby sensitive resources, and and impact of operations (e.g., seismic surveys would be much less than a large exploratory drilling rig).
  Estimated resources needed to complete this work is one to four technical specialist FTE's from BLM or FWS, all of whom have national-level workloads, and assuming data are sufficient and project is clearly defined.

Phase 2. Information needed for NEPA processes leading to drilling and production:

- Project description sufficient for NEPA purposes.

- Ambient air quality data for modeling to determine background AND assessment and tracking of cumulative impacts.
  - Long-term ambient air quality monitoring station data (NAAQS) from Nuiqsut (adjacent to NPR-A) was used for NPR-A draft EIS, but there are no local ambient air quality data available for the Arctic 1002 area.

- Collecting sufficient data to inform the NPR-A draft EIS took two years and utilized considerable BLM/FWS staff, significant contractor assistance, and additional agency (EPA) coordination.

- There is an existing BLM contractor working on the Reasonable Foreseeable Development (RFD) for the Alaska North Slope Air Quality study (NSRAQ study). This work is targeted to be complete by Spring 2019.
    - An estimated $150-200K would be required to to add to the current contract to include the Arctic 1002 project, assuming that it could be modified and a clear funding source is identified.

- AQ and AQRV modeling of air quality impacts using:
    - Near Field Modeling (AERMOD)
    - Far-Field Modeling (North Slope Regional Air Quality Modeling – NS RAQM)

  The worst-case prediction of air quality impacts needed for management decisions can reasonably be modeled.

- Northern Alaska federal lands such as Arctic NWR and Gates of the Arctic (National Park Service) requires quantitative, not qualitative, AQ and AQRV analyses prior to development under NEPA.

- Incorporation of air quality data and modeling results in IAP
    - Typically requires significant contracted assistance (or would require significant additional federal FTEs).
    - BLM and FWS must have control of the contract and would provide the contract requirements, technical input and perform the final review.
    - Contract option time frame of 24 to 30 months: initiating and awarding contract (3-4 months); complete contract work (12-15 months); review (3-6 months); incorporating work into NEPA document (3 months).

Phase 3. Information needed to protect resources during drilling and production.

- Sensitive resources specific to lease area
- Specific project development descriptions
- Likely, additional site-specific AQ and AQRV analyses
- Further developments of near-field Modeling (AERMOD) and far-Field Modeling (North Slope Regional Air Quality Modeling – NS RAQM)
    - Recent analyses examples include NPR-A Greater Moose's Tooth (GMT)-1 and GMT-2, and the proposed Willlow project. (1002 area project size is similar to Alpine, but that analysis is out-of-date and timeline or costs would not be accurate for the 1002 development.)

What information is currently available to address the information needs for subjects?

- Short-term: The process (not data) used for air impact evaluation for oil and gas development on the Kenai NWR could be used to initially analyze NO_2 impacts for seismic and exploratory drilling.
- Longer-term: Current projects in NPR-A, including GMT-1 and GMT-2 have existing near- and far-field AQ and AQRV analyses, but these would need to be expanded in scope and include location-specific ambient air quality data.

What are key information gaps?

- A clear project description that details the Reasonable Foreseeable Development (RFD). With the RFD estimate, additional high, medium or low projection are created to characterize the future potential development.

  For each stage (exploration, construction/drilling, production), project descriptions need to include:
  - number, size, and highest probability location of wells
  - number of pads
  - estimates of air emissions
  - number and location of roads
  - specific and auxiliary equipment used
  - supplemental power used (fuel, storage)
  - control technologies used
  - construction activity and equipment used
  - geographic proximity of sensitive resources
  - topography
  - emission magnitude

- Additions to current near-field and far-field modeling to include the Arctic 1002 area.

- Ambient air quality monitoring in the Arctic 1002 area and downwind (minimum of NAAQS, PM_{25}, and Prevention of Significant Deterioration (PSD)) to address cumulative impacts and support accurate modeling.

  Kaktovik residents who use the 1002 area for subsistence and other stakeholders will benefit from a long-term NAAQS air quality monitoring station (and potentially HAPS, based on Nuiqsut requests for NPR-A development) within or downwind of the Arctic 1002 area to alleviate concerns regarding air quality impacts to the community from development.

What studies/surveys need to be conducted to fill those information gaps?

- Far-field (North Slope Regional Air Quality Modeling – NS RAQM) and Near-field modeling (AERMOD) will need to be modified to incorporate the Arctic 1002 area, through extension of a current BLM contract, a new agency contract, or with additional agency personnel.
  - While not an information need *per se*, the time necessary to oversee, conduct, and incorporate needed additional air quality modeling will be significant. This includes adherence to Request for Proposal and contract processing times.

- Establish long-term NAAQS ambient monitoring stations in or near Arctic 1002 area and downwind in sensitive areas, including monitoring and study sites. Per site, equipment and startup costs = $500K and annual costs = $250-300K, depending on location, logistics, and availability of operators.

- Evaluate adequacy of current data sources to meet some needs, especially for Phase 1:
    - satellite data (e.g., validation of NO_x plumes from Prudhoe Bay, average patterns of potential pollution dispersion)
    - Limited NOAA/NWS/FAA data
    - BLM ozone study in NPR-A
    - Toolik Lake Field Station research
    - Industry-sponsored PM speciation studies at Wainright and Deadhorse.

- Establish “Interagency Monitoring of Protected Visual Environments” (IMPROVE) data collection at Toolik Research Station and a coastal site. Equipment cost =$20 - 30K and annual cost per site = $37K (2018 dollars).

- Establish ethane/methane monitoring station at Tooklik, which will help in source attribution of methane from industrial activities.

COASTAL PLAIN 1002 AREA: BIRDS

Primary point of contact (POC):
Christopher Latty, Refuge Bird Biologist
Arctic National Wildlife Refuge, Alaska Region, USFWS
christopher_latty@fws.gov, 907-347-4300

Other POCs: Roy Churchwell, USFWS Kanuti NWR (roy_churchwell@fws.gov, 907-456-0450); Greta Burkart, Arctic NWR (greta_burkart@fws.gov, 907-456-0519); Richard Lanctot, USFWS Migratory Bird Management (richard_lanctot@fws.gov, 907-786-3609); David Payer, National Park Service (david_payer@nps.gov, 907-644-3578); Ted Swem, USFWS Fairbanks Field Office (ted_swem@fws.gov, 907-456-0441); Steve Kendall, USFWS Hakalau Forest NWR (steve_kendall@fws.gov, 808-443-2300); Timothy Vosburgh, BLM (tvosburgh@blm.gov, 307-332-8400); Debora Nigro, BLM (dnigro@blm.gov, 907-474-2324); John Pearce, USGS (jpearce@usgs.gov, 907-786-7094).

What do we need to know and why regarding subjects?

The Coastal Plain of the Arctic National Wildlife Refuge (hereafter Refuge) and adjacent marine waters (including the 1002 area) are recognized as Important Bird Areas (IBA) by the American Bird Conservancy, Audubon, and Birdlife International. Prior studies have demonstrated the value of the coastal plain 1002 area to both breeding and non-breeding birds. During the short Arctic summer, millions of shorebirds, waterfowl, loons, gulls, and landbirds use the 1002 Area. At least 158 species of birds have been recorded on the coastal plain of Arctic Refuge, and birds that use the Refuge have ranges that include all 50 U.S. states and 6 continents. Of the 57 species known to regularly occur in the 1002 Area, 24 are USFWS Birds of Management Concern, 14 are USFWS Alaska Region Priority Species, and 10 are listed as Near Threatened or Vulnerable by the International Union for Conservation of Nature or are on the Audubon Red List. Two species listed under the provisions of the Endangered Species Act have been reported in the 1002 Area, although only spectacled eiders are known to currently reside and breed there.

Purposes of the Refuge, as established by the Alaska National Interest Lands Conservation Act (ANILCA), include:

- "to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to…snow geese, peregrine falcons and other migratory birds";
- "to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats";
- "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";

Applicable international treaties include the Migratory Bird Treaty. Other authorities under which we manage and conserve birds on the Refuge include the Endangered Species Act, the Bald and Golden Eagle Protection Act, and the Refuge Administration Act of 1966 as amended by the Refuge Improvement Act of 1997.

Conservation of birds in association with exploration, development, and production of oil and gas resources in the 1002 Area of the Coastal Plain of the Refuge will require information regarding:

- Contemporary abundance and distribution of breeding and non-breeding birds in the 1002 Area, with particular attention to identification of important nesting, feeding, and molting areas;
- Phenology and patterns of seasonal movement by breeding and non-breeding birds in the 1002 Area; and
- Impacts of development and disturbance to birds using the 1002 Area (including pre-development baseline data) during sensitive time periods, with special consideration given to how the dissimilarities in water availability between the 1002 Area and areas like Prudhoe Bay and National Petroleum Reserve – Alaska (NPR-A) may lead to differential impacts.

What information is available to address information needs and what are the remaining gaps?

1. Resource Inventories

Bird abundance and distribution information for the 1002 Area will help define the areas that are most important for species, or groups of species, and can therefore help define conservation and management priorities.

1.1 Historical surveys for breeding and non-breeding birds

Surveys in the late 1970s through mid-1980s in the 1002 Area included site-specific ground-based tundra breeding bird surveys on the coast and inland, breeding and post-breeding bird surveys on barrier islands and in lagoons, aerial breeding swan surveys, aerial- and ground-based breeding raptor surveys, and post-breeding snow goose surveys. Although these data provide important historical information about the bird resources of the 1002 Area, abundance and distribution for many species has likely changed as it has on the broader Alaska Coastal Plain over the intervening 40 years.

1.2 Recent surveys of breeding birds

- Ground-based surveys of breeding shorebirds were conducted throughout the 1002 Area during summer 2002 and 2004. That work found higher shorebird density in wetlands and near the Canning River Delta. Although surveys were informative, some species were encountered in low numbers, making distribution and abundance estimates unreliable.
- Aerial surveys of waterbirds, including waterfowl, loons, and gulls, have been conducted annually across much of the Alaska Coastal Plain since the mid-1980s. However, only about 1/4th of the 1002 Area is included, and what is surveyed is done so at the lowest intensity, making estimates of waterbird abundance and distribution for the 1002 Area unreliable.
- Aerial breeding bird surveys (primarily for common eiders) were conducted on barrier islands in summer 1999-2009. Ground-based surveys were conducted in summer 2003/04 and 2014-17. Aerial survey estimates were variable between years. Ground surveys revealed breeding common eider abundance on the barrier islands may have increased significantly between 1976 and 2017.
- Breeding cliff-nesting raptors were periodically surveyed in the Brooks Range, foothills, and 1002 area in the 1990s and early 2000s. Overall abundance of nesting raptors was generally low in the 1002 Area.

1.2.1 Site-specific surveys of breeding birds

The Canning River Delta on the western edge of the Refuge Coastal Plain is the only site within the 1002 Area for which contemporary, fine spatial scale breeding bird data are available. Intensive surveys focused on shorebird breeding abundance were conducted in

1979-80, 2002-07, and 2010-11. Some waterbird and passerine abundance data were also collected. This site has provided significant information on habitat use patterns and variation in phenology of tundra nesting shorebirds, passerines, waterfowl, and loons. The long-term data collected at the site also provide information on trends in abundance for birds breeding in the 1002 Area, including an apparent 15-fold increase in cackling geese since 1980.

1.3 Recent Surveys of non-breeding birds

- Boat- and ground-based coastal shorebird surveys were conducted during fall staging and migration at the major river deltas, 2006-2011. These investigations found the vast majority of shorebirds using the surveyed deltas were juveniles.
- Aerial fall-staging snow geese surveys occurred in the 1990s and early 2000s. Up to 325,000 snow geese were estimated to use the Refuge Coastal Plain in some years.
- Lagoon and near-shore surveys of post-breeding and molting waterbirds were conducted during fall 2002-2003. Up to 20, 28, 29, 33, and 41% of the yellow-billed loons, red-throated loons, long-tailed ducks, scaup, and pacific loons, respectively, counted during the entire Alaska North Slope survey occurred along the Refuge coast.
- Adults of three species of shorebirds were tagged at four sites on the ACP (including two species at one site in the 1002 Area) with GPS loggers to document use of stopover sites along the Beaufort Sea coast in summer 2017, but tagging of more individuals and species is needed before assessments can be completed.

1.4 Resource inventory gaps for breeding and non-breeding birds

Most of the current information on bird abundance and distribution in the 1002 Area was collected for only one or two years, covers only a small portion of the 1002 Area, and/or was collected at low survey intensity. In addition, the 1002 Area contains far fewer waterbodies compared to sites further west (e.g., within NPR-A), therefore birds are likely more patchily distributed. Contemporary information on bird abundance and distribution patterns in the 1002 Area are needed, especially considering that many shorebirds (either at the species or sub-species level) are declining, some goose species are increasing broadly across the North American Arctic, and habitats are changing across the Arctic Coastal Plain due to warmer, longer summers.

2. Phenology

The timing of key life events (phenology) is a critical part of nearly every important ecological relationship. For birds, the phenology of arrival, nesting, brood-rearing, and staging prior to migration likely coincides with availability of critical food and other resources. Understanding bird phenology in the 1002 Area may facilitate mitigation by conducting exploration and development activities during periods when birds are less reliant on specific areas and habitats.

2.1 Status of phenology information for 1002 Area birds

- A large amount of information on the timing of breeding is available for tundra-nesting birds from across the Alaska Coastal Plain (including the Canning River Delta), and may be reasonably extrapolated for general approximations to the 1002 Area.
- Phenological data are available for juvenile shorebirds using the 1002 Area river deltas in the late summer and fall, although substantial differences in timing among sites was detected.
- Some phenology information is available for molting sea ducks and waterbirds using coastal lagoons from studies in the 1980s, but surveys were generally conducted only a few times across several months, therefore the range in timing of peak use is not known.

- Reasonably good information is available on the general phenology of snow geese using tundra areas during fall staging from studies conducted through the early 2000s.
- Raptor phenology is fragmented and limited to observations of birds on nests during surveys along major rivers during the 1990s and 2000s.
- Adults of a few shorebird species were tagged in summer 2017 with GPS loggers at the Canning River Delta. These devices may provide phenology data for the post-breeding season if recovered.

2.2 Information gaps for bird phenology

- Although surveys have demonstrated the importance of the Refuge lagoons for waterbirds, there is poor understanding of the phenology of their use of this habitat. In addition, climate-mediated changes to the Beaufort Sea nearshore areas may be affecting benthic prey communities and ice conditions, and therefore the timing of when birds use the lagoons could be affected.
- Post-breeding phenology of adult shorebirds using the 1002 Area is poorly understood, and so far, the only data available from recently deployed tracking devices are for buff-breasted sandpipers from breeding locations to the west of the Refuge.
- The amount of time birds remain at key stopover sites is virtually unknown for most birds using the 1002 Area. These data are important for calculating disturbance or displacement risk and determining seasonal abundance estimates.

3. Potential impacts of development and disturbance

Oil and gas development may impact breeding and post-breeding birds through building and line strikes, loss or alteration of habitat, increased predator abundance, disturbance, and contamination.

3.1 Knowledge on impacts to birds from oil and gas development and disturbance

Numerous studies have been conducted on the impacts of development and disturbance to nesting and non-breeding birds at Prudhoe Bay and in NPR-A since the 1970s. Additionally, several studies on the potential impacts of industrialization and disturbance to birds were conducted in the 1002 Area. Results of some projects focused on impacts to birds can be found in summary documents, including the Refuge Coastal Plain Resource Assessments and Updates (e.g., Garner and Reynolds 1986, Garner and Reynolds 1987), Refuge Coastal Plain Terrestrial Wildlife Research Summaries (Douglas et al. 2002, Pearce et al. 2018), and the National Research Council report on the cumulative environmental effects of oil and gas activities on Alaska's North Slope (National Research Council 2003).

3.2 Information gaps for potential impacts to birds from oil and gas development and disturbance

- Before an assessment of potential impacts of development can be conducted, better information on abundance, distribution, habitat use, and phenology of breeding and non-breeding birds in the 1002 Area is required. Therefore, the topics below only address the most apparent immediate needs.
- The extent to which wetlands will be lost due to water use for oil and gas development needs to be better understood to evaluate impacts on birds. Exploration and development activities generally require substantial volumes of freshwater, but the 1002 Area contains less than $1/10^{h}$ the density of lakes compared to areas to the west where oil and gas activities are ongoing. In addition, 1002 Area lakes tend to be shallower and freeze to the bottom during winter. Therefore, wetlands and waterbodies, especially where clustered, have high value for birds inhabiting the 1002 Area. Because of this, activities that affect the

availability, seasonality, or flow of water could have different effects on birds, their habitats, and their foods in the 1002 Area compared to areas further west, but how and to what extent is unknown.

- Changes in the avian predator community makeup, predator abundance, and impacts to avian productivity are some of the most commonly described consequences of industrial activity for birds breeding on the Alaska Coastal Plain. Shelter associated with winter exploration activities may attract predators such as arctic fox and raven. Little is known about the contemporary predator community makeup or abundance in the 1002 Area.
- Limited contemporary exposure data for birds are available for contaminants related to oil and gas development in the 1002 Area.

What studies/surveys need to be conducted to fill information gaps?

- Conduct aerial- or ground-based inventories of breeding birds. Species groups should include waterfowl, loons, gulls, shorebirds, and landbirds and should also include both area-wide and site-specific surveys. These data will provide contemporary information on distribution and abundance and help identify important areas for birds. Prioritization of surveys should be based on conservation needs. Because this information may be important to leasing, and because year-to-year variability will require baseline data to be collected over several years, surveys should begin as soon as possible.
- Conduct aerial- or ground-based inventories of Brooks Range, foothills, and Coastal Plain rivers for breeding cliff-nesting raptors. Because raptors may begin using the Coastal Plain while winter exploration activities occur, these surveys/studies should begin in the near future.
- Conduct surveys to estimate abundance and distribution of predators of birds and eggs. Additional studies should also be conducted to determine current makeup of nest predators for common or sensitive bird species, and gather baseline information on movement patterns of foxes in the 1002 Area. Because high annual variability will require baseline data to be collected over many years, surveys and studies should begin as soon as practical.
- Conduct studies on the foraging ecology of nest predators and how individuals choose food items and adjust diet patterns based on alternative prey. Objectives should target ways to inform potential management actions if local predator abundance is found to increase in response to oil and gas related activities.
- Determine post-breeding abundance, distribution, habitat use, and phenology of waterfowl and loons in lagoons, and of shorebirds in deltas and coastal areas. Prioritization should be based on species' conservation need and sensitivity to disturbance and development.
- Investigate how water availability and the patchiness of waterbodies in the 1002 Area affects how disturbance and development may impact birds.
- Update baseline contaminant exposure information for birds breeding in the 1002 Area and using deltas and lagoons for fall staging, with particular emphasis on hydrocarbon exposure and how contaminant burdens may affect reproduction, survival, and subsistence value and human health.
- The above studies should incorporate how predators and birds adjacent to the 1002 Area may change their behavior in response to activities directly associated with 1002 Area oil and gas development.
- Much of the data from surveys and studies conducted in the 1002 Area are not widely available. The Refuge is working with FWS Science Applications to build a publically accessible database for the long-term dataset for the Canning River Delta tundra nesting bird project. Comparable efforts should follow for other projects to ensure appropriate storage and management of important data and allow for public data access to both contemporary and historical data.

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REPORTING TEMPLATE

- **Discipline/Subject Area: Caribou**

- **Lead facilitator:** Stephen M. Arthur, U.S. Fish and Wildlife Service, stephen_arthur@fws.gov, 907-455-1830.

- **Individuals contacted:**

  HeatherJohnson, USGS, heatherjohnson@usgs.gov, 907-786-7155;
  Brad Griffith, USGS, dbgriffith@alaska.edu, 907-474-5067;
  David Payer, NPS, david_payer@nps.gov, 907-644-3578;
  Patricia Reynolds, FWS (retired), patricia@reynoldsalaska.com;
  Fran Mauer, FWS (retired), fmauer@mosquitonet.com;
  Ken Whitten, Alaska Dept. of Fish and Game (retired), kwhitten89@gmail.com;
  Roy Churchwell, FWS, roy_churchwell@fws.gov, 907-456-0450;
  Eric Wald, NPS, eric_wald@nps.gov, 907-455-0624;
  Jason Caikoski, Alaska Dept. of Fish and Game, jason.caikoski@alaska.gov, 907-459-7300
  Mike Suitor, Yukon Department of Environment, mike.suitor@gov.yk.ca, 867-993-6461
  Shannon Stotyn, Canadian Wildlife Service, shannon.stotyn@canada.ca, 867-667-3929.

- **What do we need to know and why regarding subjects?**

  The purposes of the Arctic National Wildlife Refuge, as established by the Alaska National Interest Lands Conservation Act include:

  - "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 …);
  - "to fulfill the international fish and wildlife treaty obligations of the United States";
  - "to provide the opportunity for continued subsistence uses by local residents";

  In addition, the International Agreement for the Conservation of the Porcupine Caribou Herd (1987) obligates the governments of the United States and Canada to:

  - "conserve the Porcupine Caribou Herd and its habitat through international co-operation and coordination so that the risk of irreversible damage or long-term adverse effects as a result of use of caribou or their habitat is minimized";
  - "ensure opportunities for customary and traditional uses of the Porcupine Caribou Herd" by rural Alaska residents and members of Canadian First Nations;

Conservation of the Porcupine caribou herd in association with the exploration, development, and production of oil and gas resources on the coastal plain of the Arctic Refuge will require information regarding:

- Importance of the 1002 Area relative to caribou birth rates, calf survival, and overall herd health;
- Likelihood and consequences of disturbance or displacement of caribou from the 1002 Area (or portions thereof) during calving and post-calving seasons;
- Potential impacts of development on access to caribou by hunters and on viewing opportunities of other Refuge visitors;

➢ **What information is currently available to address the information needs for subjects?**

- The Porcupine caribou herd occupies a range of approximately 130,000 square mi (337,000 square km) spanning the border between Alaska and Canada. The herd is an important cultural and economic resource utilized by local and indigenous people in Alaska and the Yukon and Northwest Territories of Canada. Approximately 2,000 – 3,000 caribou are harvested annually, mostly by subsistence users. In addition, viewing the large aggregations of caribou that occur during summer is a unique experience valued by visitors from across the U.S. and around the world.
- Telemetry data from collared adult female caribou from the Porcupine herd have been collected since 1982. These data indicate that this herd migrates to the Arctic coastal plain of northeastern Alaska and northwestern Canada for calving during early June. The area used for calving for all years combined extends approximately from the Canning River in Alaska to the Babbage River in Yukon Territory, Canada and includes the 1002 Area of the Arctic Refuge. Additional aerial surveys conducted over the coastal plain beginning in the 1960s, and surveys of relative abundance of bone and antler specimens on the tundra dating back to the early 20th century confirm that this area has been used for calving for many decades, and likely for millennia. Annual distributions of caribou during the calving season have varied among years; however, the highest densities of calving caribou were within the central coastal plain of the Arctic Refuge, including the 1002 Area, during many years.
- Predator densities are lower within areas of the coastal plain used for calving compared to neighboring areas in the foothills of the Brooks Range.
- Availability of high-quality food plants consumed by caribou during the calving season is greater within the calving range than in neighboring areas to the south and east.
- Modeling the potential effects of displacement of the caribou calving range from the coastal plain suggested that this would expose caribou calves to higher rates of predation and lower quality forage.

- During 1982-1998, caribou from the Porcupine herd used the 1002 Area and neighboring coastal areas of the Arctic Refuge for insect relief habitat during late June and early July of most years. From 1999-2017 caribou moved through this area after calving but the duration of use was variable and generally shorter than during the previous period, and most caribou moved south into the Brooks Range or east into Canada during early July.
- All arctic caribou herds fluctuate in size over periods of several decades. However, the rate of change (both increase and decline) of the Porcupine herd has been slower than other herds in arctic Alaska. The herd increased slowly during the 1980s, reached a peak of 178,000 in 1989, declined to approximately 123,000 in 2001, then increased to its current population of 218,000 in 2017.
- Studies of the Central Arctic caribou herd in developed areas west of the Arctic Refuge suggested that pregnant female caribou avoided roads and other oil field infrastructure during the calving period. Avoidance of infrastructure was less evident or absent among non-pregnant females and males. Caribou were more tolerant of human disturbance during mid to late summer, when caribou movements are largely driven by insect harassment. When human activity is low, caribou may even seek out raised gravel pads, roads, or structures to escape insect harassment.
- Prior to development, the area surrounding Prudhoe Bay was used by Central Arctic caribou for both calving and as insect relief habitat. The intensive development that occurred in this area apparently caused caribou to shift their calving distribution southward, and to cease using the developed area for forming the large aggregations that occur in response to insect harassment. Caribou seem to be more tolerant of the lower density of infrastructure associated with more recent installations west of Prudhoe Bay and have continued to use developed areas near the Kuparuk and Milne Point oil fields for insect relief.
- Displacement of Central Arctic caribou from preferred calving areas near Prudhoe Bay was associated with reduced calf size at birth, but the difference was not sufficient to cause a statistically detectable reduction in calf survival.
- Elevating pipelines to a minimum of seven feet above ground and separating roads and pipelines by at least 300 feet reduced the impact of linear features that might obstruct caribou movements.
- Despite any negative impacts that might have occurred during the period of development, the Central Arctic caribou herd grew from approximately 10,000 caribou in the late 1970s to a peak population of 70,000 in 2010. The herd subsequently declined to 22,000 in 2016.

➢ **What are key information gaps?**

Much of the available information regarding effects of oil field development on caribou came from studies of the Central Arctic herd during the 1980s and 1990s. These studies did not utilize the sophisticated analytical methods that have been developed since then, and most were limited to documenting large-scale distribution

patterns, comparing density of caribou at varying distances from infrastructure, and observing changes in caribou numbers over time. In addition, many studies were of limited duration and had low statistical power to detect differences in demographic rates (survival, reproduction, and population change). Because of the variety of natural factors that drive caribou demographics (e.g., variation in climate, weather, forage quality, predator abundance) and the general tendency of caribou herds to fluctuate in abundance, these studies provide only limited information to evaluate the potential impacts of development on the Porcupine caribou herd. Furthermore, there are significant geographic differences between the ranges of the Central Arctic and the Porcupine herds. For example, the coastal plain used for calving by the Central Arctic herd extends up to 100 mi (160 km) inland from the Arctic coast to the foothills of the Brooks Range; whereas, the coastal plain used by the Porcupine herd is only 10-40 mi (16-64 km) wide and contains a much smaller proportion of moist and wet sedge tundra habitat used by caribou for feeding during early summer. These differences suggest that impacts on the Porcupine herd could be greater due to the relative scarcity of alternative calving and post-calving habitat within the range of that herd. Key information gaps include:

- Estimated rates of survival and recruitment are not sufficiently precise to detect biologically significant differences among years;
- Lack of understanding of what drives the variation in calving site selection by caribou;
- Little empirical data are available concerning the potential physiological and demographic effects of displacement of caribou from preferred calving and insect relief habitats (e.g., evaluate the value of the 1002 Area in providing higher nutrition, reduced predation, and access to insect relief habitat in comparison to other areas).
- Data are needed to assess effectiveness of existing measures used to mitigate effects of disturbance on caribou and to develop more cost-effective measures;
- Research is needed to differentiate the effects of disturbance from natural variation in caribou distribution, abundance, and demographic parameters;.
- Limited understanding of how interchange of caribou between neighboring herds might affect population dynamics of those herds.

What studies/surveys need to be conducted to fill those information gaps?

Exploration phase:

- Increase demographic/behavior monitoring: To improve precision of estimates of survival, birth rates, and recruitment so that changes in important demographic parameters can be detected, monitoring intensity should be increased (number of radiocollared caribou and monitoring effort). This monitoring should use GPS collar technology so that fine-scale behavior data can simultaneously be collected, increasing the ability to understand the influence of habitat conditions on demography. Such data would also reveal emigration rates to neighboring

herds. Increased field monitoring would also facilitate the following proposed studies (potential cost: $75,000-$100,000 annually);

- Assess factors associated with calving site selection: Identify and evaluate the relative importance of climate, predator abundance, forage quality, insect harassment, population density, and anthropogenic disturbance on calving site selection using a combination of long-term and newly collected data; Estimated cost: $75,000 annually for 5 years. Should be done during exploration period so that impacts of future development can be differentiated from natural drivers.
- Investigate characteristics associated with post-calving distribution: Use long-term and newly collected data to understand the influence of weather, forage conditions, insect harassment and population density on caribou movement and resource-selection patterns during the post-calving period. Estimated cost: $150,000 annually for 5 years. This information will be needed during the development phase to guide design and placement of infrastructure.
- Analyze existing telemetry data to quantify seasonal ranges and migration routes: A large database of telemetry data exists that could provide valuable baseline information on caribou movements. These data need to be formally analyzed to update the report “Sensitive Habitats of the Porcupine Caribou Herd” (International Porcupine Caribou Board, 1993). Estimated cost: $25,000 (seasonal salary; no costs other than staff time); this information is needed to identify sensitive areas that may require special management during development and production.
- Monitor body condition and survival: Existing long-term monitoring programs should be continued to predict population trends and evaluate the roles of natural vs. anthropogenic factors. These data will be needed to evaluate causes of future changes in population size that are likely to occur during the development and production periods.

Development and production phase:

- Continue monitoring caribou movements: Monitoring data are needed to identify calving areas and seasonal ranges and to quantify caribou recruitment and survival; Estimated cost: $250,000 annually, collaboration with state, federal, and Canadian agencies, cost sharing to be determined.
- Identify drivers of caribou fitness traits (body condition, survival and recruitment): Use long-term and newly collected data on collared individuals to quantify the effects of annual variation in summer and winter forage conditions (vegetation type, nutritional condition), weather (phenology, snow depth and density, icing events), predator abundance, population density, insect harassment and human activity on caribou body condition, survival and recruitment; Estimated cost: $200,000 annually for 5 years. This information will be needed to differentiate potential effects of displacement from variation due to natural causes, to evaluate mitigation measures that are applied, and to develop improved mitigation strategies.
- Monitor body condition and survival: Long-term monitoring of basic physiological and demographic traits is necessary to predict population trends and evaluate

the roles of natural vs. anthropogenic factors. These data will be needed to evaluate causes of future changes in population size that are likely to occur during the development and production periods.

- Project future changes in distribution and demography: With an improved understanding of the factors that influence the behavior and demography of Porcupine caribou (see previous needed studies), the influence of development within the 1002 Area on the herd can be projected, along with expected future changes in other key factors (i.e., climate, insect harassment, forage conditions). Estimated Cost: Analysis time after the other studies have been completed.

REPORTING TEMPLATE

Discipline/Subject Area: Coastal resources

Lead facilitator: Wendy Loya, Arctic LCC wendy_loya@fws.gov, 907-786-3532

Technical Reviewers:

Bruce Richmond (Coastal geologist; brichmond@usgs.gov)

Li Erikson (Coastal and ocean engineer; lerikson@usgs.gov)

Ann Gibbs (Coastal geologist; agibbs@usgs.gov)

Guy Gelfenbaum (Center Director; ggelfenbaum@usgs.gov)

Ben Jones (Research Geographer; bjones@usgs.gov)

Kenneth Dunton (Professor of Marine Science; ken.dunton@utexas.edu)

Cathy Coon (Chief Env Sciences, catherine.coon@boem.gov)

Warren Horowitz (Oceanographer, warren.horotwitz@boem.gov)

Amy Holman (AK Regional Coordinator, amy.holman@noaa.gov)

What do we need to know and why regarding subjects? We discussed that decisions affecting/involving coastal resources would include the following resource development issues: sea ice roads, sea ice airstrips, barge access, coastal infrastructure (e.g. pads, pipelines, docks), water treatment (desalinization input/output; other discharges), offshore gravel resources.

To address these issues, we need to understand:

1. Sea ice dynamics
2. Coastal erosion
3. Coastal & Barrier Island geomorphology
4. Coastal bathymetry
5. Coastal habitats
6. Coastal water quality and chemistry

What information is currently available to address the information needs for subjects?

1. Sea Ice Dynamics: Understanding the timing and duration of sea ice may affect seasonal access.
    a. Studies conducted, underway and proposed by Beaufort Lagoon Ecosystem LTER, which includes the Kaktovik and Jago Lagoons.

i. Open-access Synthetic Aperture Radar from the Sentinel-1a satellite will be used to monitor ice formation and breakup conditions throughout the Alaska Beaufort Coast.

ii. Time lapse cameras and meteorological stations on 3-meter towers adjacent to each lagoon system to capture freeze-up, break-up and ice-out (220° field of view with red, green, blue, infrared and thermal imagery) and measure air temperature, atmospheric moisture, wind speed and direction, soil temperature and moisture, photosynthetically active radiation, and atmospheric pressure

b. Mapping and Characterization of Recurring Spring Leads and Landfast Ice in the Beaufort Sea to understand the spatial and temporal distribution of sea ice and leads in support of coastal access and wildlife habitat.

i. Mahoney, A., H. Eicken, L. Shapiro, R. Gens, T. Heinrichs, F. Meyer, and A. Graves-Gaylord. 2012. **Mapping and Characterization of Recurring Spring Leads and Landfast Ice in the Beaufort and Chukchi Seas. Final Report.** OCS Study BOEM 2012-067, University of Alaska Fairbanks and USDOI, BOEM Alaska OCS Region, 154 p. https://marinecadastre.gov/espis/#/search/study/7020

2. Coastal erosion: Coastal erosion will affect lands available for leasing, infrastructure siting, and potentially access from land to sea and vice versa. Rates of erosion available every 50m for Arctic Refuge from USGS Change for entire coastline of Arctic Refuge published in 2015

a. Gibbs, A.E., and Richmond, B.M., 2015, National assessment of shoreline change—Historical shoreline change along the north coast of Alaska, U.S.–Canadian border to Icy Cape: U.S. Geological Survey Open-File Report 2015–1048, 96 p.

b. Lidar along entire coast was acquired between 2009-2012, and are incorporated into an updated report

i. https://pubs.er.usgs.gov/publication/ofr20171107

ii. GIS data: https://www.sciencebase.gov/catalog/item/57e96bd2e4b09082500c91b0

3. Coastal & Barrier Island geomorphology: Understanding the coastline will be important if access to the refuge from offshore ice or waters is desired and to inform erosion modeling. Barrier islands take the brunt of storm impacts and erosion, especially at inlets. Critical to protecting erodible coastline. The

USGS led a study to evaluate barrier island stability and projected change. Overall, elevational data for the coastline is sufficient; however morphology data could be better and is the focus of several ongoing and newly initiated projects.

a. General descriptions of coastline in Gibbs, A.E., and Richmond, B.M., 2015, National assessment of shoreline change—Historical shoreline change along the north coast of Alaska, U.S.–Canadian border to Icy Cape: U.S. Geological Survey Open-File Report 2015–1048, 96 p., http://dx.doi.org/10.3133/ofr20151048.
    i. Updated report: https://pubs.er.usgs.gov/publication/ofr20171107
    ii. GIS data: https://www.sciencebase.gov/catalog/item/57e96bd2e4b09082500c91b0
b. Historical shoreline change rates dating back to 1947 and computed from T-sheets, satellite imagery, and airborne lidar were used to assess the stability of the mainland shores and Arey Island. In order to evaluate future stability and the ability of Arey Island to mitigate wave energy delivery to the lagoon, hindcast (probable past conditions: 1981-2010) and future coastal storm conditions (2011-2100) were simulated with a suite of numerical models. Model simulations were further used to quantify anticipated changes in flood frequency, duration, and extent of Arey Island and coastal wet sedge areas along the mainland shores of Arey Lagoon.
    i. Erikson, L.H., Gibbs, A.E., Richmond, B.M., Storlazzi, C.D., Jones, B.M., Ohman, K.A., 2018, Changing Storm Conditions in Response to Projected 21st Century Climate Change Scenarios and thePotential Impact on an Arctic Barrier Island –Lagoon System: A Pilot Study for Arey Island and Lagoon, Eastern Arctic Alaska, U.S. Geological Survey Open File report, *in press.*
c. NOAA Shorezone, includes imagery for coast and barrier islands, classifications https://alaskafisheries.noaa.gov/
    i. Length of homogenous shoreline unit
    ii. Habitat classification
    iii. Biological Wave Exposure
    iv. Oil Residency Index
    v. Coastal Classification
    vi. Environmental Sensitivity Index (substrates)
d. Studies conducted, underway and proposed by Beaufort Lagoon Ecosystem LTER, which includes the Kaktovik and Jago Lagoons.

i. Annually for each lagoon and once every 5 years for the entire Beaufort Sea Coast, coastline and barrier island position and morphology will be digitized from high spatial resolution pan-sharpened orthorectified WorldView2 satellite imagery acquired at no cost from the Polar Geospatial Center.

4. Coastal bathymetry: This information is needed to understand seafloor morphology/depth, gravel deposits and identify habitat for coastal species out to approximately 20m water depth. Bathymetry was last completed in 1940's. Industry has done work in their areas of interest, but not offshore of 1002 area.
5. Coastal habitats: Impacts of coastal activities, desalinization/discharge could affect coastal ecosystems, including habitats that Threatened and Endangered Species depend on as well as fish and migratory birds.
    a. NOAA Shorezone, including habitat classification for coast and barrier islands, classifications https://alaskafisheries.noaa.gov/
    b. Studies conducted, underway and proposed by Beaufort Lagoon Ecosystem LTER, which includes the Kaktovik and Jago Lagoons.
        i. Benthic and water column biota assessments; microbes; fish surveys; community subsistence catch sampling.
6. Coastal water quality and chemistry:
    a. Studies conducted, underway and proposed by Beaufort Lagoon Ecosystem LTER, which includes the Kaktovik and Jago Lagoons.
        i. Samples will be collected during ~2 week field campaigns during (a) the ice-covered period in April, (b) during and immediately following ice break-up in June, and (c) during the open-water period in July/August. The season-specific data from these field campaigns will be complemented by continuous data streams for select parameters measured with sensors.
        ii. Sampling: Water biogeochemistry: Seasonal Alkalinity, NO3, NH4, DOC, DON, CDOM, POC, PON, stable isotopes, fatty acids, Chl. (HPLC)
        iii. In-situ sensors (moorings), Continuous monitoring of pH, temperature, salinity, water level (wave height and sea level), velocity.
        iv. In-situ sensors (discreet) Seasonal pCO2, temperature, salinity, O2, pH, PAR, Chlorophyll (chl), NEP/GPP/R, velocity

What are key information gaps?

1. Sea ice dynamics

2. Coastal erosion: We need updated shoreline erosion/change rates. Sandia National Laboratories and partners have proposed developing a predictive model of thermos-abrasive erosion for the permafrost Arctic coastline, which will complement efforts by the Beaufort Lagoon Ecosystems LTER (See sec 4. Coastal Habitats) and BOEM's Wave and Hydrodynamic Modeling in the Beaufort Sea (Stefansson Sound). USGS will conduct research on shoreline change in 2018 to understand coastal bluff and beach change.
    a. Overview presentation available at: https://www.iarpccollaborations.org/members/documents/10925?utm_medium=email&utm_source=transactional&utm_campaign=Weekly
    b. BOEM's Wave and Hydrodynamic Modeling in the Beaufort Sea is calibrated for Stefansson Sound, but will be informative along the broader coastline https://www.boem.gov/po-ak-17-01/

3. Coastal & Barrier Island geomorphology:
    a. Need more information on substrates, including ice content/permafrost, sediment composition, grainsize, etc.
    b. Recent observations of brown tundra along coast suggest salt-kill of tundra due to inundation; sometimes recovers when apparently associated with storm surges, but some areas have not recovered since 19070's suggesting subsidence. GPS instrumented monuments across area coast would provide information on changes in elevation, and this could be a component of the BLE LTER monuments if not already.
    c. Given the importance of barrier islands in protecting the erodible coast, a better understanding of barrier islands is needed to understand how they will change in a warmer, ice-free environment. Some have a thick tundra core, others may be entirely sediments; process is that they roll inland and are dynamic at a decadal scale now, but how will that change with altered runoff and increased storms?
4. Coastal bathymetry This information is needed to understand seafloor, gravel deposits and identify habitat for coastal species out to about 20m water depth.
5. Coastal habitats: Although it will take several years to assemble the baseline, the BLE LTER will make significant contributions to this topic. Study of Fish of nearshore Beaufort Sea planned by USGS in 2018.
6. Coastal water quality and chemistry: Need water quality and sedimentation baselines to understand changes associated with development; much of this baseline information will be collected as part of the new Beaufort Sea LTER

What studies/surveys need to be conducted to fill those information gaps? If possible, please include duration (start and end), staffing and cost estimates.

A significant number of studies are underway by USGS, BOEM and the National Science Foundation (NSF) funded Beaufort Sea Lagoons Long Term Ecological Research project. Continued funding support of the personnel and research for these projects is important.

1. Sea Ice Dynamics
2. Coastal erosion
3. Coastal & Barrier Island Geomorphology
4. Coastal bathymetry
5. Coastal habitats
6. Coastal water quality and chemistry

REPORTING TEMPLATE: Contaminants in Resources Other Than Air

Lead facilitator:
Dr. Angela Matz, Environmental Contaminants Specialist, U.S. Fish and Wildlife Service, angela_matz@fws.gov, 907-271-2778, 907-750-8527 (cell)

Individuals contacted:
- Christopher Latty, Arctic NWR, christopher_latty@fws.gov, 907-456-0471
- Greta Burkhart, Arctic NWR, greta_burkhart@fws.gov, 907-456-0519
- John Trawicki, USFWS R7 Refuges I&M, john_trawicki@fws.gov, 907-786-3474
- Sue Braumiller, USFWS (Hydrologist), sue_braumiller@fws.gov, 775-861-6332

What do we need to know and why regarding subjects?

- *Legal, policy and management basis*:
    - ANILCA: Continued use of subsistence resources, and quality and quantity of water resources
    - Arctic National Wildlife Refuge Comprehensive Conservation Plan (CCP)
    - National Environmental Policy Act (NEPA)
    - Clean Water Act (CWA)
    - Endangered Species Act (ESA)
    - Marine Mammal Protection Act (MMPA)

- *Contaminants of concern* associated with oil and gas exploration and development (air emissions addressed elsewhere) include:

    - Heavy metals (cadmium, chromium, lead, mercury, nickel)
    - Salts
    - Naturally occurring radioactive materials (NORMS)
    - Components of dissolved and dispersed oil: Benzene-Toluene-Ethylbenzene-Xylene (BTEX), phenols, aliphatic and aromatic hydrocarbons (e.g., polycyclic aromatic hydrocarbons or PAHs), carboxylic acid, other volatile and semi-volatile organics
    - Many other industrially produced chemicals associated with equipment and camp maintenance, and oil and gas operations (e.g., batteries, compressors, heaters/separators)
    - Chemicals that are of concern to human health and safety, including:
        - arsenic, heavy metals, hydrochloric and sulfuric acids, hydrogen sulfide gas, BTEX, 1,1,1-trichloroethane, 1,2 - dichloroethane, chloroform,
        - cyclohexanone, methyl ethyl ketone, methyl isobutyl ketone

    - Sources of these include large and small spills, injection wells (saltwater disposal, other waste disposal, hydraulic fracturing), drilling muds (may include diesel, oils, detergents), drill cuttings, oily waste pits, other waste fluids such as produced water, hydraulic fracturing fluids, solid waste such as clays, precipitates, minerals, and suspended solids, landfill leachate, sewage lagoons, POL (Petroleum, Oil and Lubricants), dust, small spills from equipment failures (well casings, truck transport, pipe and tank corrosion, fittings failure), and abandoned equipment such as batteries, storage tanks, and electrical equipment.

- *Sensitive resources*:
    - Aquatic habitats: rivers, lakes, groundwater, springs
    - Terrestrial habitats: soil, vegetation
    - Species groups:
        - Birds (from generally lowest to highest trophic level; higher trophic levels tend to accumulate higher contaminant concentrations):
            - Waterfowl (ducks, geese, seaducks) - important subsistence resource, including spectacled eiders which are listed under the ESA
            - Shorebirds - 1002 area is breeding area of international importance
            - raptors - some raptors on the North Slope already have elevated mercury concentrations
        - Fish - freshwater, anadromous fish are used for subsistence
        - Caribou - used for subsistence:
        - Polar bears - listed under the ESA and the MMPA
    - Fish, wildlife, and vegetation used for subsistence

What information is currently available to address the information needs for subjects?

- In the late 1980's, "baseline" data were captured in a scientifically and statistically sound manner (Contaminant Baseline Studies of the Arctic Coastal Plain 1002 Area and Adjacent Lagoons, Arctic National Wildlife Refuge, Alaska, 1988 - 1989). However, these data are too old to be used as pre-operational, or current baseline, data.
- There are contemporary data directly from the 1002 area on mercury in shorebirds (Perkins et al. 2016); trace elements in common eiders (Miller et al. in prep); and certain contaminants in polar bears (USGS unpubl. data). There are other data from across Arctic Alaska that may provide transferable information. All data would have to be evaluated for use as baseline data for oil and gas exploration and drilling.

What are key information gaps?

- Lack of contemporary contaminant concentrations in almost all sensitive resources that would serve as baseline data for NEPA, oil spill planning, and NRDAR.
- Complete project description, including timetable.
- Description of potential hazards to humans (including subsistence users) and the environment. These should be addressed in the NEPA process for all phases, but will need to be reviewed by the U.S. Fish and Wildlife Service.
- Disposal methods for all waste, including sewage, produced water and drilling muds. These should be addressed in the NEPA process for all phases, but will need to be reviewed by the U.S. Fish and Wildlife Service.

- Monitoring plans, including pre-operation baseline, for contaminants of concern and sensitive resources. These should be addressed in the NEPA process for all phases, but will need to be reviewed by the U.S. Fish and Wildlife Service.

- Full disclosure, characterization, and tracking of hazardous materials, including potential proprietary mixtures, which may be disposed of in the 1002 area, including by injection, to protect groundwater and springs. This may not be entirely addressed during the NEPA process, especially if proprietary information is involved.

What studies/surveys need to be conducted to fill those information gaps?

- The U.S. Fish and Wildlife Service does not currently have sufficient FTEs with environmental contaminants knowledge and skills to conduct or review studies, or evaluate NEPA documents, for oil and gas exploration or drilling in the 1002 area.

- Develop statistically sound contaminant monitoring program with enough power to detect biologically significant changes in contaminants concentrations, and changes in contaminants concentrations that may exceed regulatory thresholds. Include:

    - Evaluate sampling locations and matrices from previous contaminants baseline study for sufficiency as monitoring sites and matrices, and evaluate current data for suitability as baseline data.

    - Add site-specific monitoring sites and matrices depending upon project description to provide baseline (pre-project) data.

    - For groundwater monitoring, include location, depth, and monitoring interval of groundwater wells that would identify changes from baseline specifically for springs.
- Hydrological evaluation of underground aquifers and surface waters, including springs, in the 1002 area to avoid and minimize contaminant migration potential.

- Updated baseline sampling in fish, especially those used for subsistence, of contaminants associated with oil and gas development including heavy metals, persistent organics, NORMs, and hydrocarbons.

- Updated baseline contaminant exposure information for birds breeding in the 1002 area, and those using deltas and lagoons for fall staging, with particular emphasis on hydrocarbon and heavy metal exposure, and how contaminant burdens may affect subsistence value.

- Continued collection of polar bear contaminants exposure data, with an emphasis on hydrocarbon and heavy metal exposure.

REPORTING TEMPLATE

Discipline/Subject Area: Cultural Resources

Lead facilitator: Edward J. DeCleva, Regional Historic Preservation Officer, U.S. Fish and Wildlife Service, 1011 East Tudor Road, MS-235, Anchorage, AK 99503. Telephone: (907) 786-3399. Email: edward_decleva@fws.gov.

Individuals contacted:

Robert King, State Archaeologist, Bureau of Land Management, Alaska State Office. (907) 271-5510.

Joseph Keeney, Archaeologist, Bureau of Land Management, Arctic Field Office. (907) 474-2312.

Jeffrey Weinberger, Alaska Heritage Resources Survey Manager, State of Alaska Office of History and Archaeology. (907) 269-8718.

Sarah Meitl, Review and Compliance Coordinator, State of Alaska Office of History and Archaeology. (907) 269-8720.

Hollis Twitchell, Assistant Manager, U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge. (907) 456-0512.

What do we need to know and why regarding subjects?

Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of its actions (in this case permitting oil and gas exploration and extraction) on historic properties (defined as prehistoric and historic objects, features, structures, sites, and districts).

In order to consider effects, we will need to know the nature, extent and locations of historic properties (hereinafter, cultural resources) and evaluate these alongside specific oil and gas exploration and operations proposals.

Recorded cultural resource sites consist of consist of prehistoric and historic features (eg., drying racks and graves), structures, tent rings and artifact scatters.

Threats to cultural resources include disturbances caused directly by seismic testing, installation of ice roads, support facilities and drill pads.

Mitigation measures are consideration of avoidance, minimization, and data recording (via archaeological excavation).

What information is currently available to address the information needs for subjects?

Previous cultural resource investigations in the Arctic Plain 1002 area are limited to the coast, some waterways and the northern foothills of the Brooks Range. Key sources include:

Grover, Margan A. and Erin Laughlin
2012 Archaeological Survey of the Mid-Beaufort Sea Coast: An Examination of the Impacts of Coastal Changes on Cultural Resources.

Hall, Edwin. S., Jr. and David Libbey
1982 Preliminary Archaeological and Historic Resource Reconnaissance of the Coastal Plain Area of the Arctic National Wildlife Refuge, Alaska.

Generally, these concentrated on limited aerial and pedestrian reconnaissance surveys of areas modeled to likely have high potential to contain archaeological resources. Collectively, the surveys identified several prehistoric to early historic period seasonal occupation sites consisting of:

a. Structures and features such as log cabins, sod houses, graves, ice cellars, and drying racks. Most occur adjacent to Beaufort Sea coast, although a few have been found on river courses several miles inland.

b. Tent ring complexes generally located on well-drained river banks, terraces, ridge lines and hill/bluff tops that provide extensive views across the surrounding landscape.

c. Lithic artifact scatters, not associated with features or structures, located adjacent to watercourses.

What are key information gaps?

Previous cultural resource inventories and investigations in the Arctic Plain 1002 area have been limited to theoretically predicted high potential areas along the coast and some watercourse segments. We do not know the extent of cultural resource sites across the landscape.

What studies/surveys need to be conducted to fill those information gaps?

Cultural resource investigations will be necessary to sufficiently identify cultural resource sites, determine the significance of such sites, to evaluate effects to sites determined eligible under National Register of Historic Places criteria, and to determine avoidance, minimization and mitigation standards for eligible sites that would be adversely affected by oil and gas activities.

USFWS should commit one full-time GS-0193-11 archeologist to oversee agency cultural resource investigation permitting and Section 106 responsibilities during the duration of oil and gas exploration and extraction operations development.

Subject Area: Fishes

Lead facilitator: Randy Brown, U.S. Fish and Wildlife Service, <randy_j_brown@fws.gov>, (907 456-0295

Individuals contacted: Vanessa von Biela, USGS, <vvonbiela@usgs.gov>, (907) 786-7073; Mathew Whitman, U.S. Bureau of Land Management, <MWhitman@blm.gov>, (907) 474-2249

What do we need to know about fishes and why:

Water is essential fish habitat. Water is also a critical component in virtually all stages of the industrial process of hydrocarbon development. Potential sources of water for industrial use along Alaska's North Slope include rivers, lakes, snow, and ice; perhaps even desalinated marine sources. Fish depend on the aquatic environments of nearly all rivers, many lakes, and the near-shore marine areas in or adjacent to the 1002 Area. Surplus water, water that is present in rivers and lakes and in the form of snow and ice, that is not required to sustain fish populations, would conceivably be available for industrial use. If our goal is minimizing the impact of industrial development on fishes that live in or migrate through the 1002 Area we must identify water that is required to sustain them and preserve that water for fish use.

In addition to direct industrial use of water, seismic activity during the exploratory phase of hydrocarbon development has the potential to impact fishes as well. In recent years winter seismic surveys most commonly use a truck-based technology called Vibroseis to generate the acoustical energy pulses necessary to locate subsurface geological formations that might contain oil or gas. Vibroseis is much less harmful to fishes than explosive charges that were commonly used in the past. These downward directed pulses of acoustic energy create pressure waves into the ground or through ice into lakes and rivers below. They are known to influence the behavior of fish in the vicinity of the energy source, although experimental data suggest it does not cause the physical damage typical of explosives.

What information is currently available to address the information needs for fishes:

The eastern North Slope in Alaska is endowed with limited freshwater options for fish. As a result, there are only a few species that occupy the freshwater habitats that are available. Lake density is very low east of the Canning River drainage but increases progressively to the west. Several mountain streams cross the coastal plain between the Canning River and the Canadian border. These streams flow during summer with snowmelt, rainfall, perennial springs, and for some streams, melting glaciers, however, only the perennial springs provide flow during winter reducing habitable environments for fishes to about 5% of what is available during summer.

The nearshore environment in the southern Beaufort Sea, adjacent to the coastal plain of the eastern North Slope in Alaska, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie River and other rivers along the eastern Arctic coastline. The lagoons are relatively shallow, the amplitude of the tides is very small (≤30 cm), barrier islands restrict flow to some extent, and the environment becomes much less salty and much warmer than sea water outside the barrier islands. The lagoons are very productive foraging environments for marine and anadromous species during summer. In winter, in part because of reduced flow between lagoons and the sea, and in part because of ion exclusion during ice formation, lagoons become hypersaline environments that get even colder than normal sea water under ice. As winter approaches and the lagoons begin freezing up, anadromous fishes return to freshwater environments and marine fishes retreat to adjacent marine habitats.

Freshwater species present in the eastern North Slope of Alaska include lake trout *Salvelinus namaycush*, Arctic char *S. alpinus*, Dolly Varden *S. malma*, Arctic grayling *Thymallus arcticus*, round whitefish *Prosopium cylindraceum*, burbot *Lota lota*, ninespine stickleback *Pungitius pungitius*, and slimy sculpin *Cottus cognatus*. Slimy sculpin are known to occur only in drainages west of the Canning River. Round whitefish and burbot are present in the Canning River and large drainages farther west but not east of the Canning River. Lake trout and Arctic char are found only in certain lakes. Dolly Varden is present in three life history forms: anadromous populations in which most members rear in freshwater rivers for 2–4 years then begin migrating to sea to feed each summer; residual dwarf males of the anadromous populations that choose to stay in freshwater rivers rather than migrate to sea; and dwarf resident populations that exist in perennial springs and isolated lakes. Arctic grayling occur in some lakes and also in rivers with perennial springs that are used for overwintering habitat. Ninespine stickleback occur as both freshwater residents and as anadromous forms. They are common in lakes within the coastal plain and the lower reaches of many rivers throughout the eastern North Slope.

Anadromous species known to occur in or adjacent to the eastern North Slope of Alaska include Dolly Varden, ninespine stickleback, Arctic cisco *Coregonus autumnalis*, broad whitefish *C. nasus*, humpback whitefish *C. clupeaformis*, least cisco *C. sardinella*, chum salmon *Oncorhynchus keta*, pink salmon *O. gorbuscha*, Chinook salmon *O. tshawytscha*, and rainbow smelt *Osmerus mordax*. Dolly Varden and ninespine stickleback are the only anadromous species in this group that maintain populations within the rivers of the eastern North Slope. Dolly Varden are known to migrate long distances along the coast during their summer feeding forays, east to the Mackenzie River and west to the Colville River or beyond, and some individuals migrate into offshore waters as well. Ninespine

stickleback appear to be much more localized in nearshore environments. Arctic cisco have natal origins in the Mackenzie River to the east but disperse as juveniles to coastal habitats farther west including the Colville River delta, where many overwinter in brackish environments. Rearing Arctic cisco make annual feeding migrations along shore during summer and eventually return to the Mackenzie River to spawn. Broad whitefish, humpback whitefish, and least cisco that are encountered in nearshore environments in the eastern Arctic have natal origins in either the Mackenzie River to the east or the Sagavanirktok or Colville rivers to the west. Salmon species that occur in the eastern Arctic are thought to be strays from southern Chukchi or northern Bering Sea populations, although some believe that self-sustaining chum salmon populations may exist in the Mackenzie River drainage somewhere. Rainbow smelt are known to spawn in the Mackenzie and Colville rivers as well as in the Kuk River drainage farther west. Dolly Varden and Arctic cisco are the primary food fishes for people in north east Alaska.

There are about 12 species of marine fishes that are commonly encountered in nearshore brackish environments, only four of which are relatively abundant during the summer season. These are fourhorn sculpin *Myoxocephalus quadricornis,* Arctic flounder *Pleuronectes glacialis,* saffron cod *Eleginus gracilis,* and Arctic cod *Boreogadus saida*. While anadromous species tend to migrate along shore in the southern Beaufort Sea, marine species are thought to follow a very different pattern; moving towards shore and into shallow water during summer and away from shore and into deeper water during winter. It is not uncommon to find these four common marine species in brackish environments during summer, or even in the very lower reaches of the rivers in the area.

What are the key information gaps:

We currently have a good understanding of fish species present in or near the 1002 Area, as well as the types of aquatic habitats they use. We have some information on species presence in specific lakes, streams, and near-shore habitats. We don't have this information for all aquatic habitats that might be considered for exploratory seismic surveys or industrial water use. This information will be important prior to permitting for these activities.

We do not have a good understanding of the consequences of harvesting aufeis from perennial springs on flow levels downstream the next summer. Will it be adequate to support fish migration or not? This information will be important prior to permitting the use of aufeis.

What studies or surveys need to be conducted to fill those information gaps:

REPORTING TEMPLATE: Oil Spills

Lead facilitator:
Dr. Angela Matz, Environmental Contaminants Specialist, U.S. Fish and Wildlife Service, angela_matz@fws.gov, 907-271-2778, 907-750-8527 (cell)

Individuals contacted:
Veronica Varela, USFWS, veronica_varela@fws.gov, 907-786-3866
Dr. Philip Johnson, DOI, philip_johnson@ios.doi.gov
Grace Cochon, DOI, grace_cochon@ios.doi.gov

What do we need to know and why regarding subjects?

- *Legal, policy and management basis* for oil (and other hazardous materials) spill planning, response, and restoration include:
    - Oil Pollution Act (OPA), including Natural Resource Damage Assessment and Restoration (NRDAR)
    - Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
    - National Contingency Plan (NCP)
    - Endangered Species Act (ESA)
    - Marine Mammal Protection Act (MMPA)
    - National Environmental Policy Act (NEPA)
    - U.S. Department of the Interior and U.S. Fish and Wildlife Service (Service) policies
- *Concerns* associated with oil (and other hazardous materials) spills in the event of oil and gas exploration and development include:
    - Exposure of sensitive resources to dissolved and dispersed oil, including Benzene-Toluene-Ethylbenzene-Xylene (BTEX), phenols, aliphatic and aromatic hydrocarbons (e.g., polycyclic aromatic hydrocarbons or PAHs), carboxylic acid, other volatile and semi-volatile organics and potentially, heavy metals, and their effects on biota managed by the Service. Also, adverse perturbations in the ecosystem upon which Service trust resources rely due to exposure of any ecosystem component to these substances.
    - Exposure and recovery of sensitive resources to response activities (e.g., use of heavy equipment, trenching and digging, use of dispersants or *in-situ* burns, etc.).
    - The effect of any interaction between climate change and adverse exposure to oil or other hazardous substances on the fitness of Service trust resources on the individual and population levels.
    - Lack of logistic capacity to respond to spills in the 1002 area, and limited capacity elsewhere on the North Slope.
- *Sensitive resources*:

- Aquatic habitats: shorelines, near-shore marine waters and lagoons, rivers, lakes, groundwater, springs

- Terrestrial habitats: soil, vegetation

- Species groups:
  - Birds (seabirds, waterfowl, shorebirds, raptors), including eiders listed under the ESA
  - Fish (freshwater and anadromous)
  - Polar bears - listed under the ESA and the MMPA
  - Terrestrial mammals, including caribou, muskox, grizzly bears, and small mammals that have important roles in the Arctic ecosystem food web

- Fish, wildlife, and vegetation used for subsistence

What information is currently available to address the information needs for subjects?

- In the late 1980s, "baseline" data on environmental contaminants were captured in a scientifically and statistically sound manner (Contaminant Baseline Studies of the Arctic Coastal Plain 1002 Area and Adjacent Lagoons, Arctic National Wildlife Refuge, Alaska, 1988 - 1989). However, these data are too old to be used as pre-assessment data for spill response (resources at risk) and NRDAR purposes.

- National and statewide oil spill planning tools exist and can be updated (e.g., shoreline Environmental Sensitivity Index (ESI) maps; NOAA's Arctic Environmental Response Management Application (ERMA): https://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma/arctic-erma.html). These tools inform oil spill planning and response; however, they are generally focused on coastal and marine habitats. Tools for the 1002 area, especially inland, may need updating.

What are key information gaps?

- NRDA pre-assessment data identified as "information gaps" under other Reporting Templates. These include biological and other trust resource survey data. For example, date-specific locations, species, numbers, and habitat-based activities (e.g., breeding, staging) of waterfowl and shorebirds. If breeding in the Arctic, quantitative information on reproductive success. These data would also help inform contingency planning and spill response activities, including identification of resources at risk.

- Oil spill response plans and contingency plans, based on seismic project applications and NEPA project descriptions.

- Full disclosure, characterization, and tracking of hazardous materials, including potential proprietary mixtures, for spill planning purposes. Including ecological toxicity data for both components and mixtures of hazardous substances.

What studies/surveys need to be conducted to fill those information gaps?

- Identify shoreline segments for Shoreline Classification and Assessment Techniques (a spill response technique used when assessing the degree of oiling).

- Evaluate data layers in Arctic ERMA and other oil spill planning tools to determine suitability for adequate spill response relative to proposed activities. Inland areas are especially data poor.
- Evaluate project-specific oil spill response plans, focusing on how fish and wildlife resources are addressed.
- NRDA pre-assessment data needs to be enumerated in other Reporting Templates.
- Area-specific surveys of wildlife presence, numbers, and reproductive success, addressing all times of the year.
- Toxicity testing on wildlife.

REPORTING TEMPLATE

- **Discipline/Subject Area: Terrestrial mammals other than caribou**

- **Lead facilitator:** Stephen M. Arthur, U.S. Fish and Wildlife Service, stephen_arthur@fws.gov, 907-455-1830.
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- **Individuals contacted:**

  Wendy Loya, FWS, wendy_loya@fws.gov, 907-786-3532;
  David Payer, NPS, david_payer@nps.gov, 907-644-3578;
  Patricia Reynolds, FWS (retired), patricia@reynoldsalaska.com;
  Fran Mauer, FWS (retired), fmauer@mosquitonet.com;
  Ken Whitten, Alaska Dept. of Fish and Game (retired), kwhitten89@gmail.com;
  Roy Churchwell, FWS, roy_churchwell@fws.gov, 907-456-0450.

- **What do we need to know and why regarding subjects?**

  The purposes of the Arctic National Wildlife Refuge, as established by the Alaska National Interest Lands Conservation Act include:

  - to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, …, grizzly bears, muskox, Dall sheep, wolves, [and] wolverines, …;
  - 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,

  Conservation of the mammals in the Arctic National Wildlife Refuge in association with the exploration, development, and production of oil and gas resources on the coastal plain will require information regarding:

  - Importance of the 1002 Area relative to distribution, abundance, reproduction, and habitat requirements of mammal species;
  - Likelihood and consequences of disturbance or displacement of mammals from the 1002 Area (or portions thereof) due to exploration and development of petroleum resources;
  - Potential impacts of development on access to the area by subsistence hunters and trappers, and on viewing opportunities of other Refuge visitors;

  Major mammal species or species groups of concern include:

  Carnivores

  - Documenting the location of grizzly bear dens near areas of on-going human activities is needed on an annual basis to avoid disturbing bears and to reduce potential human-bear conflicts. Seasonal diets of bears should be evaluated,

and effects of supplemental food (primarily garbage) on bear distribution, behavior, and rates of reproduction and growth, and the frequency of human-bear conflicts need to be monitored. Periodic density estimates for grizzly bears in the 1002 area and the neighboring foothills will be needed to assess long-term population-level effects on bears and resulting effects on prey species.

- Studies of effects of human activities, including provision of supplemental food and construction of roads and pipelines, on populations and distributions of red and arctic foxes are needed to assess potential effects on both foxes and their prey (ground-nesting birds and rodents). Competitive relationships between fox species also need to be monitored.

- Little is known about wolf and wolverine densities and relationships with infrastructure on the North Slope. Surveys are needed to document wolf and wolverine abundance and distribution and to identify den sites.

Herbivores

- Changes in moose distribution and abundance are likely to occur as a result of shrub expansion on the coastal plain, and potential effects of winter snow conditions should be monitored to understand changes in moose populations and availability of moose for subsistence hunters.

- Information is needed to assess the major factors limiting distribution and abundance of moose and muskox (e.g., forage quality and abundance, weather, predation, disease).

- Abundance and density of muskoxen within the Arctic Refuge should be monitored to determine if muskoxen return to the Refuge from adjacent areas and if this is influenced by oil field infrastructure or changes in abundance and distribution of predators and other prey species.

- Distribution, abundance, and habitat associations of arctic ground squirrels should be documented. Ground squirrels are a key species in the Arctic, in that they are an important prey for many predators and can influence vegetation communities by consuming vegetation and by fertilizing the tundra around their colonies. Thus, changes in ground squirrel populations can have profound effects on local communities.

- Population levels of microtines and other small rodents should be monitored to determine the timing and magnitude of population highs and lows and how these relate to other components in the ecosystem, especially population dynamics of mesocarnivores and their alternate prey (ground-nesting birds). Effects of climate

change on the distribution and dynamics of small mammals should also be investigated.

- Small mammal species (rodents and shrews) on the coastal plain should be inventoried; particularly species for which little is known, such as the holarctic least shrew. Very little data are currently available concerning which small mammal species occur on the coastal plain, or their population status.

- The distribution and abundance of hares on the coastal plain should be documented, and species identity should be determined (snowshoe vs. Arctic hare). Hares are a key species of the boreal forest, and are likely to increase their range northward as the climate warms. This will have far-reaching effects on both vegetation and other mammals and birds.

➢ **What information is currently available to address the information needs for subjects?**

Surveys of the abundance and distribution of several mammal species were conducted during the Arctic National Wildlife Refuge Coastal Plain Resource Assessment studies of the 1980s. These included studies of muskoxen, moose, Dall's sheep, wolves, arctic foxes, wolverines, grizzly bears, arctic ground squirrels, and other rodents. Much of this information was limited to documenting the occurrence and, in some cases, estimates of abundance of these species. Since 1987, some additional surveys have been conducted to monitor abundance and distribution of muskoxen, moose, and Dall's sheep and to collect demographic data on some of these. Small mammal species occurrence along the Canning River and a few other locations has been documented.

- Grizzly bear use of the 1002 Area varies seasonally. Bear abundance is greatest during early summer; bear density in the area at this time was estimated at 1 bear per 30 square mi (78 square km). Most bears that use the coastal plain move into the foothills for denning, but approximately 5% of grizzly bears den on the coastal plain. Bears commonly prey on caribou, moose, muskoxen, ground squirrels, and small rodents, as well as berries and other vegetation. Across northern North America there is evidence of increasing abundance of grizzly bears along the arctic coast; however, no data are available to determine if this has occurred in the Arctic Refuge. Denning bears are susceptible to disturbance from human activities during winter (particularly seismic exploration). Disturbance may cause bears to abandon their dens and suffer increased rates of mortality. This risk is especially high for newborn bear cubs.
- Arctic foxes are widespread and relatively common near the arctic coast during summer. Red foxes are fairly common inland, and may be increasing in abundance along the coast. Where both species occur, red foxes have been

observed killing arctic foxes. Sudies in Scandinavia suggest that red foxes may outcompete arctic foxes and may be the cause of declining arctic fox populations in some areas. The principal prey of both species during summer includes a variety of small mammals and ground nesting birds, but particularly brown and collared lemmings. Lemming populations in the Arctic cycle in abundance, with large peaks in abundance occurring approximately every 4 years, and arctic fox abundance generally cycles in response to changes in lemming abundance. There is evidence from Scandinavia that the magnitudes of these cycles have been reduced in recent years in association with a warming climate. Reduction or elimination of fox population cycles is predicted to have negative effects on alternate prey species, such as ground-nesting birds. In addition, provision of supplemental food, such as garbage, is likely to increase fox abundance near industrial infrastructure, and this may reduce survival of some ground nesting bird species. On the Alaskan North Slope, arctic foxes have a high incidence of rabies, but little is known about the relationship between disease and fox population dynamics or the potential for rabies to spread to other species.

- Wolves and wolverines are present but not abundant on the Arctic coastal plain. During the 1002 resource assessment studies of the 1980s, the locations of several wolf dens were documented. However, little is known about current wolf or wolverine abundance and distribution in the Arctic Refuge.
- Moose densities are generally low on the Refuge's coastal plain in winter, but some moose that spend the winter along drainages in the mountains use the 1002 area in summer. Survey data suggest that moose numbers along these drainages declined during the late 1980s and remained low through approximately 2010. More recent surveys suggest a moderate increase in moose abundance has occurred in areas to the east and west of the 1002 area, but little change is evident within this area.
- Muskox abundance in the Arctic Refuge peaked at approximately 300 during the mid 1990s, then declined to near zero by 2006. Since then, small groups of muskoxen have been found occasionally within the Refuge during summer; these most likely are animals that live primarily east of the Refuge in Canada or on Alaska state land west of the Canning River. The population decline was likely due to a combination of predation and other factors, including winter weather, disease, and changes in distribution of other ungulates.
- Dall's sheep do not occur in the 1002 Area but are found in the Brooks Range Mountains to the south, where the species reaches its northernmost geographic extent. The eastern Sadlerochit Mountains, near the southern border of the 1002 Area, contains habitat suitable for sheep, and the species has occasionally been seen there. Sheep are sensitive to disturbance from noise and aircraft traffic, particularly during the lambing season (mid to late May). Dall's sheep populations throughout the Brooks Range peaked during the 1980s, declined steeply during the early 1990s (most likely due to adverse weather), increased slowly through approximately 2011, then declined again during 2012-2014 in association with a

series of severe winters. Surveys during 2015-2017 suggested that lamb production and survival were relatively high, and the population may once again be increasing.

- Ground squirrels have a patchy distribution in the 1002 Area because denning habitat is limited by a lack of well drained soils. In areas where ground squirrels occur, they are an important source of food for foxes, bears, wolves, wolverines and weasels.
- Microtine rodents, particularly brown lemmings, are year-round residents of the 1002 Area and are an important source of food for many species including bears, wolves, foxes, and wolverines in years when they are abundant. Extreme fluctuations in population abundance affect the abundance and distribution of lemming predators as well as predation on other species such as ground nesting birds.
- Hares have been documented in the mountains of the Brooks Range and on the arctic coastal plain further west. Presumably these are snowshoe hares from more southern distributions, but they also may be arctic hares coming from Canada. Hares are a valuable resource for predators in areas where they are abundant. Hare populations can increase quickly and can affect local vegetation communities, with cascading effects on other herbivores. The presence of hares could increase the presence of lynx, a species that has been observed in the 1002 area in past years.

➢ **What are key information gaps?**

- We need a greater understanding of predator/prey and competitive relationships among red and arctic foxes, lemmings, and ground-nesting birds; how these are affected by lemming cycles; and how these complex relationships may be altered by a warming climate and anthropogenic disturbance.
- We lack current data regarding the abundance and distribution of grizzly bears; the relative importance of the 1002 area as denning habitat is unknown; improved methods are needed to reduce availability of anthropogenic foods and the resulting negative interactions with human activities.
- Current data are needed regarding the distribution and abundance of wolves and wolverines; to document den site locations and habitat attributes; evaluate potential for disturbance or mortality related to interaction with human activities; and evaluate effects of increased access by subsistence hunters and trappers.
- More information is needed regarding how predation, weather, disease, and nutrition influence population dynamics of moose and muskoxen; the potential for reestablishment of muskoxen in the Refuge by expansion of neighboring populations; and the potential effects of human activities (positive: protection from predators; or negative: disturbance or displacement) on both species.

- Are lemming cycles changing? How does this affect survival and population dynamics of ground-nesting birds? Does this moderate or increase effects of human activities?
- We have only limited knowledge of which mammal species are present on the coastal plain; information is particularly needed for little-known species and those whose ranges are restricted to arctic tundra.

➢ **What studies/surveys need to be conducted to fill those information gaps?**

Exploration phase:

- Develop methods to estimate abundance of fox and lemming populations; monitor changes over time; and assess impacts on nesting birds. Estimated cost: $70,000 annually for 3 years to develop and verify techniques. This information will be needed to distinguish between natural influences and potential effects of future development, and to assist with the design and siting of future infrastructure.
- Estimate abundance of grizzly bears in the 1002 Area during June. Estimated cost: $100,000 during one year, or $50,000 per year for 2 years. This baseline information will be needed to assess potential effects of future development.
- Continue annual surveys for moose and muskoxen that systematically cover the 1002 area. Parameters should include abundance, distribution, sex and age structure, reproduction and survival. Estimated cost: $10,000-$20,000 per year. These ongoing surveys are needed to assess responses of these species to human activities and habitat changes.
- Investigate factors limiting distribution and abundance of muskoxen on the eastern North Slope. Collaboration with Alaska Dept. of Fish and Game and Yukon Dept. of Environment. Potential cost: $100,000 annually for 5 years; cost sharing to be determined. Expansion of muskoxen back into the Arctic Refuge would greatly enhance the chances of survival for this small and fragmented population. These data are needed to evaluate potential effects (both positive and negative) of development and operation of oil field infrastructure.
- Investigate the relationship between climate change, vegetation, and moose population dynamics. Could be built into ongoing monitoring work; primary cost would be additional staff time for data analysis plus ~$10,000 per year for browse surveys. These data are needed to differentiate between natural and anthropogenic effects on moose populations. Study should begin prior to development to provide baseline information on this population.
- Revisit wolf dens documented during the 1980s to see if any are still being used and identify any new den sites. Wolf observations during seasonal surveys for ungulates would provide some indication of wolf packs that occupy the 1002 area. Estimated cost: $10,000. Wolf dens are thought to be rare within the 1002

Area; however, any that are found should be flagged for special management consideration.

- Record observations of wolverines and their tracks during late winter surveys for ungulates to obtain information on relative abundance and distribution. Potential denning habitats of wolverines with kits should be mapped using satellite imagery or other methods. (No cost other than staff time, assuming ungulate surveys are funded). Surveys should begin prior to development to provide baseline information.
- Conduct an inventory of small mammal occurrence on the coastal plain. Estimated cost: $30,000 annually for one to 4 years. There is a critical need for baseline information prior to development of the coastal plain. This information will be needed to guide the design and siting of future infrastructure.
- Map the distribution of potential ground-squirrel habitat. This may be possible from satellite imagery based on local vegetation or in combination with broad-scale vegetation or soils mapping efforts. (No cost other than staff time). This information will be needed to guide the design and siting of future infrastructure.

Development and production phase:

- Conduct long-term monitoring of relative abundance of foxes and lemmings, and their effects on nesting birds; Estimated cost: $20,000 annually, in collaboration with shorebird and waterfowl monitoring. These data are needed to distinguish between natural and anthropogenic effects.
- Monitor occurrence and behavior of grizzly bears in relation to human activities; identify locations of dens; estimate population size at 5-year intervals. Estimated cost: $30,000 per year plus $100,000 every 5 years. This information is needed to monitor effectiveness of established mitigation measures and to ensure human safety.
- Continue annual surveys for moose and muskoxen that systematically cover the 1002 area in late winter. Estimated cost: $10,000 per year. These ongoing surveys are needed to assess responses of these species to human activities and habitat changes.
- Continue investigation of the relationship between climate change, vegetation, and moose population dynamics. Could be built into ongoing monitoring work; primary cost would be additional staff time for data analysis plus ~$10,000 per year for browse surveys. These data are needed to differentiate between natural and anthropogenic effects on moose populations.
- Develop protocols for long-term monitoring of habitat characteristics important to large herbivores, including vegetation type, nutrient quality, snow characteristics (depth, density, extent, phenology, icing events). Initial costs would be limited to additional staff time; future costs to be determined. This information will be needed to assess long-term impacts of development and to distinguish those from effects of natural processes.

- Record observations of wolves and wolverines and their tracks during seasonal surveys for ungulates to obtain information on relative abundance and distribution. An inventory of known dens should be established. (No cost other than staff time, assuming ungulate surveys are funded). This information will be used to guide design and siting of future infrastructure.
- Monitor observations of hares and their tracks to detect potential range expansion; determine species identity of hares that are observed. (No cost except staff time to compile and verify observations).

REPORTING TEMPLATE

Discipline/Subject Area: Paleontological Resources

Lead facilitator: Edward J. DeCleva, Regional Historic Preservation Officer, U.S. Fish and Wildlife Service, 1011 East Tudor Road, MS-235, Anchorage, AK 99503. Telephone: (907) 786-3399. Email: edward_decleva@fws.gov.

Individuals contacted:

Patrick S. Druckenmiller, Ph.D., Associate Professor of Geology, University of Alaska Fairbanks, (907) 474-6954.

Brent Breithaupt, Geologist (Paleontology), Bureau of Land Management, (307) 775-6052.

Robert King, State Archaeologist, Bureau of Land Management, Alaska State Office. (907) 271-5510.

What do we need to know and why regarding subjects?

The Paleontological Resources Preservation Act (PRPA) of 2009 requires the Secretary of the Interior to manage and protect paleontological resources on Federal lands using scientific principles and expertise.

The vast majority of the Arctic Plain 1002 has very little exposed geology, most of which is likely comprised of Quaternary Period deposits (personal communication with Patrick Druckenmiller). Therefore, any scientifically significant paleontological resources that may be present are most likely to be associated with Pleistocene Epoch remains, particularly mammoth, steppe bison, horse and other Ice Age mammal fossils.

The probability of scientifically significant paleontological resources older than the Quaternary Period being encountered and impacted by oil and gas exploration is low.

What information is currently available to address the information needs for subjects?

The University of Alaska Fairbanks, Department of Geology, is currently working with the Bureau of Land Management Alaska State Office to prepare a Potential Fossil Yield Classification document to identify the geologic time scale within the Arctic Plain 1002 area and to evaluate the potential for paleontological resources (p.c. with Patrick Druckenmiller).

What are key information gaps?

There have been no paleontological resource investigations conducted within the Arctic Plain 1002 area.

What studies/surveys need to be conducted to fill those information gaps?

Because USFWS has no expertise in the field of paleontology, it is recommended that the BLM paleontologist would need to advise on the subject and review any technical aspects of environmental review generated for oil and gas exploration and extraction.

Paleontological resource investigations, if any, can likely be conducted concurrent with cultural resource investigations to sufficiently identify Pleistocene Epoch paleontological resources that may be located at the surface to determine avoidance, minimization and mitigation standards.

USFWS may need to authorize and oversee paleontological research on the Arctic Plain 1002 in advance of or during oil and gas related project proposals. Responsibility for paleontological permitting lies partially with the USFWS Regional Historic Preservation Officer and can be accommodated with current regional cultural resources staffing.

Subject Area: Polar Bears

Lead (name and contact information): Dr. Patrick Lemons, Chief Marine Mammals Management, U.S. Fish and Wildlife Service, 1011 East Tudor Road, Anchorage, Alaska 99516. Phone: 907-786-3668. Email: patrick_lemons@fws.gov

Individuals Contacted: Todd Atwood (USGS), George Durner (USGS), James Wilder (FWS), Christopher Putnam (FWS), Ryan Wilson (FWS), Michelle St. Martin (FWS), and Mary Colligan (FWS).

What do we need to know and why (i.e. what decisions or determinations are required)(please address what we know about resources in the area (distribution, abundance, seasonal movements), how they may be impacted by oil and gas development, mitigation measures available and their effectiveness, subsistence activities)?

> **MMPA:** We can specify the incidental, but not intentional, taking of **small numbers** of polar bears by harassment if we can find that such harassment will have a **negligible impact** on the stock of polar bears and will not have an unmitigable adverse impact on the **availability of polar bears for subsistence uses** (emphasis added).
>
> **ESA:** Under Section 7 of the ESA we will have to conduct consultations on federal action(s) and will have to make a determination as to whether such actions would **jeopardize** the continued existence of polar bears or **adversely modify or destroy** designated critical habitat (emphasis added).

What information is currently available to address the information needs identified above (include citations)?

Information needed to make the above determinations includes population dynamics of the Southern Beaufort Sea (SBS) subpopulation of polar bears, habitat and denning ecology of polar bears in the 1002 area, the subsistence and cultural use of the 1002 Area, and information on human-bear interactions that will accompany oil and gas development. We briefly describe the current state of that information relative to our determinations below.

- Population Dynamics
    - Information on the population size and trend of SBS polar bears suggests that the population experienced a 40% decline between 2001 and 2010. However, this information also suggested that the population may have stabilized by the end of that time period. Given the current information is now 8 years old, and the uncertainty surrounding the trend of the population at the end of the time period, reliance on this information for management decisions is problematic.

- Habitat Ecology
    - Our current understanding of polar bear habitat use and denning in the 1002 area is primarily based on satellite radio collared bears from the larger SBS subpopulation. However, because we are reliant on satellite radio collars applied primarily to the western portion of the SBS, and the number of collared bears that then use is only a subset of this larger sampling effort, we generally lack an understanding of the

importance of the 1002 Area to the overall population of SBS bears. Therefore, reliance on the current information is problematic.

- Subsistence and Cultural Use
    - The only study conducted that included information concerning subsistence use and the cultural importance of polar bears in the 1002 Area was published in 1997. The information provided in that study pertaining to the 1002 Area is limited. Updated and more detailed information will be necessary as part of our determinations outlined above.

- Human-Bear Interactions
    - Because the 1002 Area was managed as a wildlife refuge in the past, no significant industrial activity and related human-bear interactions have occurred there in the last 35 years. Importantly, given the uniqueness of the habitat in this area and the importance of the 1002 Area to polar bears, reliance on mitigation measures used in the NPR-A and Prudhoe Bay may not comprehensively address potential human-bear interactions in the 1002 Area.

What are key information gaps?

- Population Dynamics
    - An accurate and current understanding of the population dynamics of the Southern Beaufort Sea subpopulation of polar bears is needed in order to estimate the impact of anticipated take (i.e. to determine small numbers and make negligible impact determinations under MMPA and jeopardy determinations under ESA).

- Habitat Ecology
    - Understanding the relationship between polar bears and environmental parameters helps us explain current habitat use patterns and make future predictions on how distribution and movement is likely to respond to predicted sea ice loss and other habitat changes. This understanding is needed in order to predict how many and how animals are likely to be impacted by proposed activities (small numbers and negligible impact determination under MMPA) and whether proposed actions are likely to adversely modify or destroy designated critical habitat (ESA determination).

- Subsistence and Cultural Use of Polar Bears
    - An activity or suite of actions can affect the availability of polar bears for subsistence use by decreasing the overall number of animals or by changing their movements.
    - Understanding polar bear movements and current hunting practices helps us understand the current availability of polar bears for subsistence hunting and predict the potential impact of proposed actions on the availability of polar bears for subsistence use (MMPA determination).
    - Maintaining clear and consistence communications and relationships with communities concerning ongoing research and development activities.

- Human-Polar Bear Interactions

- Understanding the potential spatial and temporal overlap between polar bears and oil and gas development and the factors influencing the likelihood and consequences of interactions between polar bears and those development activities is essential to our ability to determine the number of polar bears likely to be taken (small numbers determination under MMPA) and the consequences of that take to the individual animal and ultimately the stock (negligible impact determination under MMPA) and to the species (jeopardy determination under ESA).
- Identification of possible methods to avoid overlap and interactions between polar bears and Industry activities, and to reduce the potential for interactions, are essential tools to facilitating our ability to achieve a small numbers determination and reach a negligible impact determination (MMPA) as well as avoid jeopardy and adverse modification or destruction of critical habitat (ESA).

What studies/surveys need to be conducted to fill those information gaps? Please include duration (start and end), lead, and cost estimates.

- Population Dynamics
  - Estimation of abundance and population dynamics (i.e. demographic rates such as survival and reproduction). Surveys using mark-recapture methods are a more viable option than other non-invasive techniques (e.g., aerial survey).
  - Continue to evaluate emerging technologies (e.g., high-resolution satellite imagery, GPS collar reliability, collar drop off mechanism performance) for integration into existing monitoring plans.

- Habitat Ecology
  - Improve our understanding of the environmental and biological characteristics of important polar bear habitats, with a particular focus on denning habitat.
    i. Continue, expand, and improve den detection, mapping, and monitoring activities. We see higher use of habitat within the 1002 area and greater reproductive success for land-based dens.
    ii. Identify movement and land use patterns of polar bears in the 1002 area, and projected changes due to sea ice loss, especially given the increased proportion of the population coming on shore in that region. Identify potential for habitat use and behavioral patterns to be modified due to increased human activities.

- Assess Impacts to Subsistence and Cultural Use of Polar Bears
  - Periodically assess key community perspectives, values and needs regarding human-polar bear interactions and sustainable use of polar bears for subsistence purposes.

- Human-Polar Bear Interactions – Identify Current Methods and Develop New Methods to Avoid, Reduce and Mitigate impacts to Polar Bears from Oil and Gas Development Specific to the 1002 Area
  - Understand how polar bears respond to disturbance
    i. Use existing movement data to look at relationships with existing infrastructure (does it appear bears are avoiding those areas and if so what is the impact zone)
    ii. Monitor for potential disturbances at den sites

- Evaluate efficacy of mitigation measures currently used outside of the 1002 area to determine effectiveness and transferability to the 1002 area
    i. Comprehensive Review of Management Measures (e.g., season/area restrictions, den buffer zones, facility location/design)
    ii. Avoidance: Examine available data to identify areas of particularly high use or biological importance for seasonal or year round avoidance areas
- Develop new mitigation measures specific to the unique characteristics of the 1002 area to reduce the number of bears taken and the overall impact of Industry.

REPORTING TEMPLATE

- **Discipline/Subject Area**: Public Health

- **Lead facilitator** Sara Longan slongan@blm.gov 907-271-3431:

- **Individuals contacted** Once external partners are contacted, the State Department of Health and Social Science (DHSS) are public health experts and have led the multi-agency (federal, state, local) development of past Health Impact Assessments in Alaska. DHSS maintains working relationships and partnerships with public health experts statewide, including contributing authors and experts from the North Slope Borough Public Health Department, among others.

  Dr. Joe McLaughlin, Chief Epidemiologist
  joseph.mclaughlin@alaska.gov
  907-269-8000

  Sarah Yoder, Public Health Specialist
  sarah.yoder@alaska.gov
  907-269-8054

- **What do we need to know and why regarding subjects?** The Health Impact Assessment (HIA) approach is a nationally and internationally used preventive health tool that anticipates the human health impacts of new or existing development projects, programs, or policies. The overall goal of HIA is to minimize negative health effects while maximizing the health benefits of a particular action. Health Impact Assessments are not legally required in the U.S., but have been used statewide in Alaska to address specific interests and concerns raised by affected communities and have typically been used to enhance the "Public Health" analysis requirements driven by the National Environmental Policy Act (NEPA) and associated guidelines.

  The status of human health is generally well understood for North Slope communities, including Kaktovik. Public health and demographic profiles are fully described in the Health Impact Assessments completed for recent North Slope oil & gas leasing and development proposals and actions. These same documents suggest mitigation measures to lessen the effects of potential public health impacts associated with oil & gas development.

- **What information is currently available to address the information needs for subjects?** The Liberty Draft EIS released July 2017 includes a Health Baseline Assessment covering all North Slope villages and Kaktovik. A comprehensive Health Impact Assessment was released in 2013 as part of the Point Thomson Final EIS

and includes the following categories for all North Slope communities, including Kaktovik:

Social Determinants of Health
Accidents and Injuries
Exposure to Potentially Hazardous Materials
Food, Nutrition, and Subsistence Activity
Infectious Disease
Water and Sanitation
Non-communicable and Chronic Diseases
Health Services Infrastructure and Capacity

References:

BOEM, 2017. Liberty Draft Environmental Impact Statement. Bureau of Ocean Energy Management. Prepared by the Alaska Department of Health and Social Services. Available at: https://www.boem.gov/2016-010-Volume-2-Liberty-EIS/

US ACOE, 2013 (2011). Point Thomson Project Health Impact Assessment: Appendix D. Final Environmental Impact Assessment. U.S. Army Corps of Engineers. Prepared by the Alaska Department of Health and Social Services. Available at: http://www.arlis.org/docs/vol1/AlaskaGas/Report3/Report_PtThom_FEIS/appR.pdf

The Bibliographies for the Liberty and Point Thomson Health Impact Assessments are thorough and could provide supplemental reference materials and source information for additional research on specific public health categories.

NOTE: more current North Slope public health data and information will be available from on-going Health Impact Assessment work supporting the Greater Mooses Tooth 2 and Nanushuk oil & gas projects. Both project locations are distances further from the ANWR 1002 Coastal Plain when compared to the Liberty and Point Thomson projects, but may be evaluated for use in order to supplement and further inform interests as it relates to Public Health considerations made for ANWR 1002 assessments.

- **What are key information gaps?** A health baseline assessment focusing on potential health benefits and impacts from oil & gas exploration and development in the ANWR 1002 Coastal Plain does not exist. Multiple health baseline assessments are complete or in-process for oil & gas projects across the North Slope, which includes a demographic profile, baseline health assessment, subsistence activity profile, summary of harvest data, and potential mitigating factors, etc. as it relates to North Slope communities generally, and specific to Kaktovik. The outcomes and main findings from these recent Health Impact Assessments could help inform environmental assessments and information needs to address management

questions as they relate to Public Health considerations for future oil & gas exploration and development in the ANWR 1002 Coastal Plain.

- **What studies/surveys need to be conducted to fill those information gaps?** Additional health assessments, from what already exists, may not be necessary to evaluate potential health impacts from exploration activities (e.g., seismic). Some level of future Health Impact Assessment may be considered to help inform lease plan reviews and/or specific project proposals for future oil & gas development in the 1002 region.

  Project duration, timelines and costs cannot be determined without understanding the scope and phase (e.g., exploration, leasing, development, transportation, etc.) of the potential Health Baseline Assessment project.

REPORTING TEMPLATE

Discipline/Subject Area: Snow & Climate

Lead facilitator Paul Leonard- Arctic LCC paul_leonard@fws.gov 907.456.0445

Individuals contacted:

Frank Urban (Geologist; furban@usgs.gov)

Matthew Sturm (Snow; msturm1@alaska.edu)

Rick Thoman (Climate; rick.thoman@noaa.gov)

Scott Lindsay (Hydrology; scott.lindsey@noaa.gov)

Daniel Fisher (Climate; Daniel.Fisher@ak.usda.gov)

Melissa Head (Tundra Travel; melissa.head@alaska.gov)

Scott Guyer (Climate; sguyer@blm.gov)

Greta Burkart (Hydrology; greta_burkart@fws.gov)no one

John Trawicki (Hydrology; john_trawicki@fws.gov)

Chris Hiemstra (Permafrost / Snow; christopher.a.hiemstra@usace.army.mil)

Sveta Stuefer (Snow; sveta.stuefer@alaska.edu)

Chris Arp (Hydrology; cdarp@alaska.edu)

Janet Jorgenson (Vegetation); janet_jorgenson@fws.gov

What do we need to know and why regarding subjects?

Development decisions that will be affected by snow/climate information include; seismic exploration*, water availability, and ice road construction*. To better inform decisions on these issues we will need to understand:

1. Snow Depth/Density/Distribution/Snow Water Equivalent to minimize the impacts on vegetation from tundra travel. **(short-term)**
2. Active Layer cycles/depths and their dependence on soil types to better plan routes of tundra travel. **(short-term)**
3. Late Season/ Fall Hydrologic Regimes and end of season snowpack to inform water availability for ice roads. **(intermediate/long-term)**

What information is currently available to address the information needs for subjects?

1. Snow Depth/Density/Distribution: Sporadic but little systematic survey effort. Early surveys were done related to seismic activity, snow cover and tundra damage.
    a. Felix & Raynolds 1989a
    b. Felix & Raynolds 1989b

   Snowfall measurements date back to 1949 on Barter Island but were taken out of service in 1989. New stations were started miles from that site in 1998 and several are currently active (GTN-P network) with data available in the 1002 area from 2001-2015.

   Over the last 5 years the Kuparuk Basin has been surveyed using structure from motion and some LiDAR which can provide ~0.1 m depth accuracy at 2 m spatial resolution. These data products can be produced very quickly after capture but are currently limited in spatial extent.

    c. Nolan et al. 2015

   Since 2002, high-resolution commercial imagery (e.g., WorldView 1-4; IKONOS) have been collected over the 1002. A recent search of the National Geospatial-Intelligence Agency (NGA) database revealed ~30k high-resolution images (1-3 m) available (no assessment of quality control or spectral bands). These images are available at no cost other than processing.

    d. Shean et al. 2016

2. Limited information (both spatially and temporally) is available to capture the variability inside the 1002.

a. There are 27 plots with thaw depth information spanning several periods between 1984-2009 collected by the refuge staff.

b. GTN-P stations (mentioned above) monitor freeze/thaw cycles.

c. There is a network of 20 sites (measurements at depths of 10cm, 20cm, 30cm) from the coast heading south (~110 miles) operated by DNR (Northern Oil & Gas Team) along the Dalton highway corridor. Length of season data have been collected since 1969 but modern data using these stations are available from 2003 (for tundra travel).

d. Soil survey data at 1:1 million scale is best available from STATSGO.

3. Depths, volume, and sensitive fish species of the 119 largest lakes in the area have been documented (Lyons and Trawicki 1994) but little is known about the watershed area of isolated lakes in this region and the potential for lakes to be recharged during snowmelt following water withdrawal. Although hydrologic studies have been conducted on three large rivers (Pearce et al. 2018) and seven smaller rivers and streams (Lyons & Trawicki 1992), late-season hydrologic regimes are rapidly changing. More information is needed to understand these changes will impact water availability and winter travel. Much of the information about larger climatological trends in and around the refuge is available in the CCP produced in 2015.

What are key information gaps?

1. Snow Cover and Composition across both local and regional gradients of coastal plain
    a. Basic Climatology (i.e., precipitation, wind, temperature)
    b. Remote-sensing information to capture snow depth (e.g., Structure from motion, LiDAR, high-resolution satellite imagery)
    c. Snow density (e.g., what condition does the snow need to be in to minimize impacts of tundra travel)
    d. Snow water equivalent
    e. How snow cover, depth, and wind operate in concert to produce conditions amenable to tundra travel.
2. Active Layer Information
    a. How long does the subsurface need to be frozen and at what temperature/depth? Currently DNR uses a rough standard where ground temps need to be approximately -5° at 30 cm depth. Typically BLM follows this standard.
    b. How do active layer dynamics change based on soil type?
3. End of season snowpack and changing hydrologic regimes in late season (Fall).
    a. How do current climate trends impact alluvial water availability for winter activity in 1002?
    b. How does end of season snowpack contribute to lake recharge potential and water deficit?
    c. How does groundwater connectivity contribute to lake recharge potential?

What studies/surveys need to be conducted to fill those information gaps?

1. A 2016 review of methods to quantify common snow parameters can be found here. A combination of in-situ measurements (e.g., SNOTEL site, weather stations spanning N-S gradient), ground surveys, and remote sensing information will need to be collected. Currently LiDAR and structure from motion (SFM) are promising technologies that could be expanded this winter (FY 18) with limited operations currently scheduled for April. In addition, SFM sensors could be mounted to FLIR aircraft for ~ $10,000 plus processing. Operating a SNOTEL site costs approximately $3,000/yr and approximately $24,000 – $30,000 for installation. Some of the

installation may be offset by NRCS. Long-term access costs will need to be addressed in advance of siting.

2. Active layer can be monitored via weather stations but will also need to be measured with ground surveys. Soil surveys will need to be produced at a finer spatial resolution than is currently available in order to capture some of the variability in the 1002.
3. Compared to Prudhoe Bay, Kuparuk, and the NPR-A, the 1002 area lacks surface water storage in lakes which provide the main water source for ice roads. Much of the water to support winter activity in the 1002 may need to come from isolated lakes, alluvial aquifers, and/or floodplain gravel pits. End of season snowpack surveys and watershed delineation will be important to understand lake recharge potential and water deficiency. Hydrologic monitoring will need to be implemented in selected river basins (e.g., Canning). In the longer term, there is potential to develop late season monitoring technology and methods in more accessible watersheds where stations are already in place and where there is a long-term record (e.g., Kaparuk) and this could be emphasized in 2018 field efforts.

* Relevant state land use regulation: Alaska Statutes (AS) 38.05.035(a)(2) & (7) - Tundra travel permits are authorized by AS 38.05.850.

REPORTING TEMPLATE

> **Discipline/Subject Area:** Subsistence Use

> **Lead facilitator:** Hollis Twitchell, Arctic Refuge Assistance Manager, hollis_twitchell@fws.gov, 907-456-0512

> **Individuals contacted** Ed DeCleva, FWS (907) 786-3399; Vince Mathews, FWS (907) 455-1823; Stephen Arthur, FWS (907) 347-5273; Tracy Fischbach, FWS (907 786-3369) ; Jennifer Reed, FWS (907) 455-1835; Nicole Hayes, BLM ; Tracey Fritz, BLM (907) 474-2309; Mark Miller, BLM (907) 271-3212; BLM; Dan Sharp, BLM (907) 271-5713;

> **What do we need to know and why regarding subjects?**

Subsistence Legal Mandates and International Agreements

- ANILCA Section 303(2)(B) sets forth the enabling purposes for Arctic National Wildlife Refuge, one of which is to: "(*iii)...*provide the opportunity for continued subsistence uses by local residents".

- Section 810(a) of ANILCA further states: "In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands…the head of the Federal agency…over such lands…shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy or disposition of such lands that would significantly restrict subsistence uses shall be affected until the head of such Federal agency…"

- The International Agreement for Conservation of the Porcupine Caribou Herd obligates the U.S. and Canadian governments to: "conserve the Porcupine Caribou Herd and its habitat through international co-operation and coordination so that the risk of irreversible damage or long-term adverse effects as a result of use of caribou or their habitat is minimized"; and "ensure opportunities for customary and traditional uses of the Porcupine Caribou Herd" by rural Alaska residents and members of Canadian First Nations.

Iñupiat subsistence users – Kaktovik Demographics

- Kaktovik located on Barter Island, is the only village within Arctic Refuge's the coastal plain and nearest to the 1002 area. It would be the community most significantly affected by oil and gas development. Kaktovik is an Iñupiat coastal community with a high dependence upon marine and inland resources for subsistence harvests. In order to consider effects, we need to know the nature, extent and locations of subsistence resources and the cultural and subsistence practices of local residents and evaluate these along with specific oil and gas exploration and operations proposals.

- In 2010, Kaktovik's population was 239 persons with early 90 % of the population being of Native Iñupiat decent (Alaska Census Data, 2010). Participation in subsistence activities by Kaktovik households is high with 95.7 % of households using subsistence resources (ADF&G 2010). The subsistence way of life encompasses much more than just a way of obtaining food or natural materials. It involves traditions, which are important mechanisms for maintaining cultural values, family traditions, kinships, and passing on those values to younger generations. It

involves the sharing of resources with others in need, showing respect for elders, maintaining a respectful relationship to the land, and conserving resources by harvesting only what is needed. Subsistence is regarded as a way of life, a way of being, rather than just an activity (Alaska Federation of Natives 2005).

Kaktovik's Resource Seasonality and Access

- The community's harvest of subsistence resources can fluctuate widely from year to year because of variable seasonal migration patterns of marine and land based mammals, fish and waterfowl. Subsistence harvesting techniques are extremely dependent on changing weather and surface conditions at sea and on land dramatically affecting ability to access resources. Determining when and where a subsistence resource will be harvested is a complex activity due to variations in seasonal distribution of animals, migration patterns, surface access conditions, severe weather events and often complex and changing hunting regulations. Human factors such as timing constraints (due to employment or other responsibilities), equipment (or lack thereof) to participate, and hunter preference (for one resource over another or for one sort of activity over another) are important components in determining the overall community pattern of subsistence resource harvest.

Kaktovik's Mixed Subsistence and Market Economies

- Modern mixed subsistence-market economies require cash income sufficient to allow for the purchase of this mechanical equipment (boats and motors and snow machines) as well as the operational supplies such as fuel, oil, maintenance parts and equipment, firearms, ammunition, nets and traps, etc. Subsistence is focused toward meeting the self-sustaining needs of families and small communities (ADF&G 2000). Participants in this mixed economy supplement their subsistence harvests by cash employment from construction jobs, oil and gas industry jobs, commercial fishing, Alaska Permanent Fund or Native Corporation dividends and/or wages from the public or government services sectors. In Kaktovik, major employers are the North Slope Borough, City of Kaktovik and the Kaktovik Iñupiat Corporation. There are also a few private sector jobs and business such as grocery stores, motels, air carrier services and recreational wildlife viewing and boat transportation providers. The combination of subsistence and commercial-wage activities provides the economic basis for the way of life so highly valued in rural communities (Wolfe and Walker 1987).

Kaktovik's Subsistence Uses and Conflicts with other Non-local Users

- Various members of the Kaktovik community and the Native Village of Kaktovik Tribal Council (NVK) have raised the issue of low flying planes and helicopters disturbing caribou on the coastal plain and disrupting local subsistence caribou and waterfowl hunters for many years. NVK states that low flying aircraft is causing the caribou to be displaced away from the coastal areas which they access to hunt in the summer and fall seasons. They attribute much of the low flying aircraft use to non-local caribou hunters and recreational scenic and wildlife viewing visitors. They have requested Arctic Refuge for a greater law enforcement presence to prevent this type of activity from harassing wildlife and causing the displacement of local subsistence resources away from the coastal plain areas they depend upon (Native Village of Kaktovik Tribal Council Meetings).

Kaktovik's Subsistence Uses and Oil and Gas Development Conflicts

- During the January 12, 2010, Public Scoping meeting in Kaktovik for the Point Thomson Project EIS, subsistence users of the community expressed significant concerns regarding impacts from development of facilities, pipelines, roads, aircraft and operations, which could displace caribou

and other important species away from coastal areas where subsistence harvesters could access them. In citing past history regarding the original Point Thomson drilling project they said there were many restrictions to subsistence hunting around the project area and they questioned how close subsistence hunters will be allowed to hunt near the drill pads, pipeline, and other facilities, and what new restrictions will be placed upon subsistence users with this new expanding Point Thomson development project (Point Thomson EIS Kaktovik Scoping Meeting, 2010).

- Barging and fuel spills in marine waters continue to be a major concern as well as the proposed grounding of barges extending a significant distance from shore for lengthy periods of time. This they believe will affect movement of seals and various species of fish which migrate through the area. There are further concerns about the exploration, production and scale of development, and the cumulative impacts of future development over time from other off-shore and inland fields, resulting in an even larger scale of impacts upon their subsistence resources and subsistence use opportunities (Point Thomson EIS Kaktovik Scoping Meeting, 2010).

- Subsistence users stated there needs for base line studies to determine what fish, waterfowl and marine mammals are in the area, their critical habitat and population levels. This is necessary in case of a major spill or disruptions of migration patterns and timing. They say baseline information is needed in case of a major oil spill and subsequent law suits, citing the case example of the Exxon Valdez oil spill (Point Thomson EIS Kaktovik Scoping Meeting, 2010).

- The issue of noise impacts to subsistence users was raised since Kaktovik people travel, camp and harvest in the 1002 area. Commenters stated that helicopter and aircraft traffic and roads and facilities on the ground would result in combined impacts likely to drive caribou and other wildlife further away from the coastal plain areas they hunt. Questions were raised on how much aircraft traffic and vehicle traffic on winter ice and gravel roads will occur and what times of the year (Point Thomson EIS Kaktovik Scoping Meeting, 2010).

- Concerns were raised about air quality and environmental pollution caused by the burning (pilot purging and flaring) from oil and gas wells. Examples were given citing the black clouds and air pollution seen around the Prudhoe Bay oil fields. They say development of the Point Thomson oil and gas field will bring air pollution that much closure to the community of Kaktovik (Point Thomson EIS Kaktovik Scoping Meeting, 2010).

- Concerns were expressed that the Point Thomson EIS project is looking only on the small scale, not the long term impacts of future field development and expansion. The project's cumulative impacts do not take into account future development of this field over time, or that of other off-shore and inland fields. The resulting larger scale impacts to resources and our subsistence opportunities are not being fully considered. For example they cite, Prudhoe Bay and all the other surrounding oil and gas field developments and their combined cumulative impacts upon subsistence opportunities (Point Thomson EIS Kaktovik Scoping Meeting, 2010).

Kaktovik's Subsistence Species Harvest Patterns

- Marine Mammals - In years when Kaktovik residents harvest and land a whale, marine resources have composed 59 to 68 % of their total subsistence harvest. Bowhead whaling occurs between late August and early October, with the exact timing depending on ice and weather conditions (Minerals Management Service 2003). There are at least 10 whaling crews in Kaktovik, and the community has a quota of three strikes (whether the animals are landed or not). Kaktovik has what is essentially an intercommunity agreement with Anaktuvuk Pass under which muktuk, whale meat and other marine mammal products (especially seal oil) are sent to Anaktuvuk Pass and Anaktuvuk Pass sends caribou and other land mammal products to Kaktovik (Bacon et al. 2009). Other marine mammal hunting (mainly seals) can take place year-round. Kaktovik

residents also harvest a significant number of bearded and smaller seals, and the occasional beluga whale or polar bear.

- Terrestrial Mammals - Land mammals are the next largest category of harvest, ranging from 17–30 percent in those same years. The primary land mammal resource is caribou, but Kaktovik residents also harvest a significant number of Dall's sheep. Of lesser abundance and availability are muskox, moose and grizzly bears. While Kaktovik hunters have taken moose and muskox, harvest opportunities are significantly restricted due to their low population numbers. Kaktovik's annual caribou harvest fluctuates widely because of the unpredictable movements of the herds, weather-dependent hunting technology, and ice conditions. Caribou hunting occurs throughout most of the year, with a peak in the summer when open water allows hunters to use boats to access coastal and lower coastal plain areas for caribou. In the winter with snow cover snowmachines are used to hunt inland coastal plain, foothills and the north slope drainages of the Brooks Range. Both the Porcupine and Central Arctic caribou herds are hunted when seasonally available. Dahl Sheep are hunted in winter when access by snowmachine is available.

- Fishery Resources - Fish comprise 8–13 % of the total subsistence harvests. Fish may be somewhat less subject to variable surface access conditions but still exhibit large year-to-year variations. In some winter months, fish may provide the only source of fresh subsistence foods. Kaktovik's harvest effort seems to be split between Dolly Varden and Arctic Cisco, with the summer fishery at sites near Kaktovik being more productive than winter fishing on the mid and lower reaches of the Hulahula River.

- Bird Resources - Birds and eggs harvest makes up 2–3 % of the total harvest. Since the mid-1960s, subsistence use of waterfowl and coastal birds has been growing at least in seasonal importance. Most birds are taken during the spring and fall migrations. Important subsistence species are black brant, long-tailed duck, eider, snow goose, Canada goose, and pintail duck. Waterfowl hunting occurs mostly in the spring from May to early July (Minerals Management Service 2003). Ptarmigan are also a seasonally important bird.

- Furbearer Resources - Trapping of furbearers in the Kaktovik area has decreased with time. Furbearers are taken in the winter when surface travel by snowmachine is possible. Hunters pursue wolf and wolverine by searching and harvesting them with rifles primarily between March and April or in conjunction with winter sheep hunting. Some hunters may go out in the fall or early winter, but usually weather and snow conditions are poor at that time and people are more concerned with meat than with fur.

Kaktovik's Subsistence Harvests Data

- Community subsistence harvest data for Kaktovik is dated in terms of the in-depth subsistence community use surveys, which were conducted in 1985, 1986, 1992 (ADF&G). In 1995, the North Slope Borough (NSB) began to systematically collect subsistence harvest data for the eight villages in the Borough. However, the NSB was only able to collect subsistence harvest data for the village of Kaktovik in 1994-1995 and in 2002-2003.

- Subsistence harvest studies for Kaktovik in 1995 indicated that 61% of the subsistence harvest (in edible pounds of food) were from marine mammals, consisting of bowhead whales, bearded seals, ringed seals, spotted seals, polar bears, and beluga whales. Terrestrial mammals comprised another 26% of the estimated edible pounds harvested, consisting of caribou, Dall's sheep, muskox, moose, and brown bear. Fishery resources accounted for 11% of the estimated total edible pounds of harvest. Seven species of fish accounted for the 4426 fish harvested of which Arctic Cisco and Dolly Varden represented 4233 of the fish caught. The harvest of birds

accounted for the remaining 2% of edible pounds of subsistence harvest with 530 birds reported harvested (Brower et al 2000).

- In addition to the Beaufort Sea, Kaktovik residents have access to a number of rivers and lakes, which support significant subsistence fish resources. Pedersen and Linn (2005) conducted surveys of the Kaktovik subsistence fishery in 2000-2001 and 2001-2002, with estimated community harvests of fish at 5,970 pounds and 9,748 pounds, respectively. Dolly Varden, lake trout, and Arctic Cisco were the only fishery resources reported harvested by Kaktovik households in this study. Dolly Varden was the most commonly harvested fish in terms of numbers harvested and estimated harvest weight, with Arctic Cisco and lake trout ranking second and third (Pedersen and Linn, 2005).

Gwich'in Subsistence Users of interior Alaska and Canada

- Gwich'in people of northeastern Alaska and northwestern Canada have opposed drilling and development on the Refuge's coastal plain (1002 area) because its importance as a primary calving and post-calving habitat for the Porcupine Caribou Herd. These communities are heavily dependent upon subsistence uses of caribou from this herd even though they live a considerable distance from the Alaska's coast plain. Oil and gas development is seen as a threat to the safety or success of calving season and therefore, a potential impact to the health and population of the Porcupine Caribou herd to which they are dependent upon.

- Porcupine caribou are the primary subsistence resource of the Gwich'in people. In Alaska, Arctic Village and Venetie are located strategically along the herd's migration paths and they depend on the herd for their physical, cultural, social, economic and spiritual needs. In Arctic Village, caribou and moose constitute more than 90% of their subsistence harvest in weight in most years. And in Venetie, caribou constitute up to 71% of their subsistence harvest in some years (ADF&G Community Subsistence Information System).

- To the Gwich'in people the Refuge's coastal plain including the 1002 area where the Porcupine herd calves is considered a "sacred place where all life begins". Opening the 1002 area to oil and gas exploration and development threatens both the porcupine caribou and the Gwich'in way of life (Gwich'in Steering Committee, 2012).

- Any significant reduction or loss of the Porcupine Caribou Herd would have a substantial impact upon the Gwich'in communities. There is a need for an analysis of the economic value of caribou to subsistence users, and the potential economic impacts that might result if the herd is negatively affected by oil and gas exploration and development on the 1002 area.

> **What information is currently available to address the information needs for subjects?**

- Kaktovik's subsistence Use: The most recent and thorough publication regarding Kaktovik's subsistence and traditional land/marine water use patterns were prepared for the US Army Corps of Engineers Point Thomson Project EIS and published in July 2012. Appendix Q of the final EIS and Environmental Impact Statement contains the information on the "Subsistence and Traditional Land Use Patterns for Kaktovik and Nuiqsut" which was prepared by Stephen Braund and Associates at the request of HDR Alaska for the US Army Engineer District Alaska Regulatory Division.

- The Point Thomson Project is located adjacent to Arctic National Wildlife Refuge on coastal plain approximately 60 miles west of Kaktovik. In describing the affected environment for subsistence, the study team reviewed the Point Thomson Environmental Report (ER) (ExxonMobil 2009), as well as other sources of subsistence data including harvest amount data obtained from the

Alaska Department of Fish and Game (ADF&G) Division of Subsistence and North Slope Borough (NSB) Department of Wildlife Management subsistence publications. The ER included harvest data for the majority of available study years. Appendix Q includes additional harvest amount and harvest location data, including unpublished subsistence harvest data from the ADF&G Division of Subsistence and the NSB Department of Wildlife Management acquired in 2002 and unpublished subsistence harvest data acquired from the NSB in 2010. It incorporates additional data from previous Environmental Impact Statement (EIS) efforts, including issues raised during a Point Thomson EIS meeting on caribou in 2002 and subsistence use area data collected in Kaktovik in 2003. Finally, this affected environment incorporates 1995-2006 subsistence use areas collected during a Minerals Management Service (MMS) funded subsistence mapping project in Kaktovik and Nuiqsut (SRB&A 2010a).

- There is a significant lack of current and contemporary subsistence and harvest information for the villages of Arctic Village and Venetie. Ethnographic and socio-economic information is not available to assess subsistence uses and impacts to these communities if substantial declines to the Porcupine Caribou Herd occur as a result of oil and gas development and production.

Literature Review and Citations for the FWS Resource Assessment

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Bacon, J.J., T. R. Hepa, H. K. Brower, Jr., M. Pederson, T. P. Olemaun, J. C. George, and B. G. Corrigan. 2009. Estimates Of Subsistence Harvest For Villages On The North Slope Of Alaska, 1994-2003. North Slope Borough, Department of Wildlife Management. Barrow, Alaska.

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Impact Assessment, Inc. (IAI). 1990a.Subsistence Resource Harvest Patterns: Kaktovik. OCS Study, MMS 90-0039. Special Report No. 9. USDOI, MMS, Alaska OCS Region, Social and Economic Studies Program, Anchorage, Alaska.

Pedersen, S. 1990. Caribou Hunting: Land Use Dimensions, Harvest Level, and Selected Aspects of the Hunt During Regulatory Year 1987-88 in Kaktovik, Alaska. Technical Paper No. 172. ADF&G Division of Subsistence. Juneau, Alaska.

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Pedersen, S. and M. Coffing. 1984. Caribou Hunting: Land Use Dimensions and Recent Harvest Patterns in Kaktovik, Northeast Alaska. Technical Paper No. 92. ADF&G Division of Subsistence. Juneau, Alaska.

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> **What are key information gaps?**

- Currently there is no complete synthesis of cultural work (subsistence, historical, and archaeological) that has been conducted in the Arctic Refuge as a whole or in particular for the northern half of the Refuge. A limited number of archeological and historical resource surveys have taken place on the Refuge due to funding, logistical difficulties of working in remote locations and lack of infrastructure to support investigations in the Refuge. A more through and complete synthesis of what work has been completed and in what areas would help identify informational gaps and help set priorities for future work.

- Community subsistence harvest data for Kaktovik is dated in terms of the in-depth subsistence community use surveys, which were conducted in 1985, 1986, 1992 (ADF&G). In 1995, the North Slope Borough (NSB) began to systematically collect subsistence harvest data for the eight villages in the Borough. However, the NSB was only able to collect subsistence harvest data for the village of Kaktovik in 1994-1995 and in 2002-2003. There needs to be a more through and consistent collection of community subsistence harvest information.

- In 2010, Morgan Grover of the US Army Corps of Engineers conducted a survey of 70 known cultural sites along the coastal areas from Flaxman Island to the Canadian border (including the 1002 area) to examine the effects of environmental changes and erosion has had on these sites over the past 30 years. The study concluded that of the 69 previously reported cultural sites, 21 were found to be impacted to some extent by erosion or thermokarsting, and 20 had been completely eroded away. She concludes that many of the remaining cultural sites are in imminent threat of eroding in the next decade. Follow-up studies and research is needed to recover cultural information before it is lost to erosion. The report strongly recommended that selected threatened sites be documented and potentially excavated after consultation and agreement with Tribal leaders.

- In 1982, Ed Hall conducted an inventory and survey of archaeological and historical resources in the 1002 area examining areas of high archaeological and historical potential. The areas surveyed were focused on areas proposed for exploratory drilling for oil and gas and areas more likely to have cultural sites such as coastal areas and barrier islands, and along rivers and streams that crossed the 1002 area, and high points of land that have overlooks above the surrounding tundra. There is a need to reassess these areas since visitors and users have reported several graves, human remains and artifacts in these areas that have not been documented and record by professional cultural resource staff.

- The Porcupine Caribou Herd is of great importance as a major subsistence resource for both the Iñupiat and Gwich'in users in Alaska. Impacts to this herd could have significant ramifications on their traditional way of life and economics. There is a need for an analysis of the economic value of caribou to subsistence users, and the potential economic impacts that might result if the herd is negatively affected by oil and gas exploration and development on the 1002 area.

> **What studies/surveys need to be conducted to fill those information gaps?**

- Hire one Archeologist/Anthropologist GS-11/12: USFWS should hire an archeologist or anthropologist to oversee the agency's cultural resource management/compliance programs during the seismic, exploration and production phases of the oil and gas development associated with the 1002 area of the coastal plain.

- Manage Subsistence Use Data: Compile a complete synthesis of archaeological, ethnographic and subsistence work that has been completed for Arctic Refuge's north slope and 1002 areas and create a functional repository of existing contemporary and historical data. Multiple sources of published and unpublished subsistence use and harvest data reside with various agencies, organizations, tribal governments, and universities.

- Identify gaps in data: A comprehensive review of existing information is needed to identify gaps in the data and to identify priorities for future subsistence research and monitoring. This information is needed to ensure traditional subsistence use and knowledge is thoroughly and accurately considered in Federal and State proposals for subsistence regulations, as well as Refuge management actions including oil and gas development in the 1002 area.

- Establish a Subsistence Harvest Monitoring Program: A NSB/Kaktovik community supported harvest monitoring program with implementation protocols based on timely and accurate harvest information is needed to ensure long-term conservation of subsistence species of fish and wildlife and subsistence uses for qualified subsistence users. The majority of the ethnographic and subsistence data for Kaktovik and the 1002 area was collected in the 1980s and may not accurately portray current patterns in subsistence use, demographics, harvest amounts, hunting seasons, locations, or community needs.

- Conduct Oral Histories and Traditional Knowledge Study: Much valuable cultural, historic, and traditional ecological knowledge about the Refuge and the coastal plain (1002 area) is possessed by local elders. Oral histories and place names contain an enormous amount of information on traditional uses, culturally important places, historic camps and settlements, and other natural and cultural information. This information is an untapped archive that could potentially benefit historical site protection and guide management decisions setting priorities for surveys and research in the 1002 area.

- Need for an analysis of the economic value of caribou to subsistence users, and the potential economic impacts that might result if the herd is negatively affected by oil and gas exploration and development on the 1002 area.

1002 Vegetation, soils, permafrost, and wetland Resource Assessment, February 16, 2018

- Discipline/Subject Area. Vegetation, soils, permafrost, and wetlands

- Lead facilitator.

  Janet Jorgenson, Arctic NWR, USFWS, janet_jorgenson@fws.gov, 907-456-0216

- Individuals contacted.

  Josh Rose, USFWS, josh_rose@fws.gov, 907-456-0409
  Louise Smith, USFWS, louise_smith@fws.gov, 907-456-0306
  Donna Wixon, BLM, dwixon@blm.gov, 907-474-2301
  Melissa Head, Alaska DNR, melissa.head@alaska.edu, 907-451-2719
  Becky Baird, Alaska DNR, becky.baird@alaska.edu, 907-451-2732
  Scott Guyer, BLM, sguyer@blm.gov, 907-271-2384
  Martha Raynolds, UAF, mkraynolds@alaska.edu, 907-474-1540
  M. Torre Jorgenson, Alaska Ecoscience, ecoscience@alaska.net, 907-455-6374
  Cory Cole, NRCS, cory.cole@ak.usda.gov, 907-761-7759
  Cory Owens, NRCS, cory.owens@or.usda.gov, 503-414-3261
  Eric Geisler, BLM, egeisler@blm.gov, 907-271-1985

- **What do we need to know and why regarding subjects?**

  1) We need distribution maps of vegetation and wetland types, plant growth forms, soil types, near-surface ground ice, snow regime and soil depth above permafrost across the 1002 area. We also need descriptions of these types and information on relationships between them, snow patterns and human or natural disturbance. The region is particularly sensitive to surface disturbance due to the relationships between vegetation, soil water content, soil type, and permafrost. To minimize the impact of development activities and to facilitate restoration land managers will require an accurate map of sensitive habitats. In the near term this is needed to design stipulations for a seismic program that minimizes persistent damage by routing vehicles over less sensitive areas and requiring adequate snow cover and soil conditions.
  2) Impacts to be expected from three phases of oil exploration and development, and mitigation measures for each. A) Impacts if seismic exploration is done in 1002 area using current technology (eg overland vehicle travel). B) Impacts from exploratory well phase (eg temporary well pads, ice roads, overland vehicle travel). C) Impacts from production phase (eg gravel roads and pads, infrastructure). For each, we need information on short and long term impacts likely to plants, soils, permafrost and wetlands, including information for different vegetation communities, species, soil types and soil moisture conditions and for overland travel by different types of vehicles under different snow conditions. This information is needed to manage new seismic

exploration in the 1002 area and subsequent development and to design appropriate stipulations and mitigation measures.

- **What information is currently available to address the information needs for subjects?**

For 1 (above):

Classification and description of natural vegetation, soils, permafrost and wetlands of 1002 area and of the North Slope in general: Vegetation types are determined by many factors including soil texture, moisture, age and chemistry, soil depth above permafrost, slope, snow depth in winter and climate effects of distance from the coast. Vegetation is dominated by shrubs and sedges, mainly less than 2 feet tall, with a moss ground cover. Vegetation cover is nearly 100% except on floodplains. Most of the area is classified as wetlands because permafrost is near the surface and hinders soil drainage. Thaw of soil in summer is hindered by an insulating blanket of thick layers of organic soils and moss. Less than 3 feet thaws down from the surface in summer and often only ~1 foot. Large amounts of soil ice accumulate in the near-surface permafrost (often 20 – 60% of soil volume) and ice is subject to thaw if the organic layer is damaged leading to surface subsidence. About half of the 1002 area has a honeycomb-pattern surface microtopography ("polygon tundra") caused by uneven distribution of ice in the near-surface permafrost, which shows it is prone to subsidence if disturbed. The Arctic NWR 2015 Comprehensive Conservation Plan synthesizes much of the available information on these topics.

U.S. Fish and Wildlife Service. (2015). Arctic National Wildlife Refuge comprehensive conservation plan. U.S. Fish and Wildlife Service, Region 7. https://www.fws.gov/home/arcticccp/.

Maps of natural vegetation, soils, permafrost and wetlands of 1002 area:

While there is much information available for the North Slope on these topics, the tight relationships between them and their susceptibility to disturbance, there are no accurate maps of them for the 1002 area.

Vegetation Maps:

Two state-wide vegetation maps exist (NLCD and Landfire) but the scale of mapping and accuracy are inadequate for planning purposes. Ducks Unlimited produced a map of the North Slope on contract for the North Slope Science Initiative in ~2015, but used existing maps where available; maps from 1994 and 1984 were used for the Arctic Refuge portion. No new imagery classification was done for the 1002 area.

The most detailed vegetation map of the 1002 area is from 1994.

Jorgenson, J.C., Joria, P.E., McCabe, T.R., Reitz, B.E., Raynolds, M.K., Emers, M., & Wilms, M.A.(1994). User's guide forthe land-cover map of the coastal plain of the Arctic National Wildlife Refuge. In (p. 46). Anchorage, AK: U. S. Fish and Wildlife Service.

Wetlands Maps:

The National Wetland Inventory (NWI) is the only avaiable wetland map. The scale and accuracy are inadequate for planning purposes.

U. S. Fish and Wildlife Service. May 2014. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. http://www.fws.gov/wetlands/

Soils Maps:

Two general soils maps exist for the 1002 area, STATSGO2 and the Ecological Landscape Map of Northern Alaska. Both are at 1: 1M scale and are inadequate for finer scale planning purposes.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. U.S. General Soil Map (STATSGO2). Available online.

Permafrost Maps:

Jorgenson, M. T., M. Kanevskiy, Y. Shur, J. Grunblatt, C. L. Ping, and others. 2015. Permafrost database development, characterization, and mapping for northern Alaska. Report for Arctic Landscape Conservation Cooperative by Alaska Ecoscience and University of Alaska Fairbanks. 46 p.

Topographic Maps:

A new digital elevation model is available, from which topography information can be derived. Terrain of the 1002 area is hillier than the parts of the North Slope that have had oil development thus far and has higher elevations and more sloped terrain.

For seismic exploration, 2-A (above):

Information on vegetation, soils, permafrost or wetlands impacts and recovery from vehicle traffic during seismic programs between 1984 and 2001:

Three studies of vegetation and soils impacts from seismic exploration conducted before 2002 generally had similar results showing that overall, vegetation impacts did occur on over half of the trail length but were generally low and mostly recovered in the first decade. Trail visibility was rated separately and usually recovered over the first few years. The studies showed that

some vegetation types were more impacted than others and recovered more slowly, including drier soil conditions more than wetter and shrubby types more than sedge types. All three documented more damage and less recovery on camp move trails than on seismic lines. Two studies tracked recovery for at least 15 years, showing that 10 – 20% of the camp move trails were still disturbed 15 years after exploration. This was sometimes due to ground subsidence that caused the trail to become a wetter trough. Higher damage on camp trails was attributed to the use of higher ground pressure vehicles and the sheering action of camp trailers on skis pulled across the tundra by tractors. Management implications and mitigation measures were discussed.

The study of 1980s seismic trails in the Arctic Refuge also highlights the need to monitor disturbed areas for at least five years afterward exploration. Depth to permafrost, trail subsidence and plant community dissimilarity measures increased gradually on trails over the first four years after exploration.

Jorgenson, J.C., Hoef, J.M.V., & Jorgenson, M.T. (2010). Long-term recovery patterns of arctic tundra after winter seismic exploration. *Ecological Applications, 20*, 205-221

Jorgenson, M. T., J. E. Roth, T. C. Cater, S. Schlentner, M. E. Emers, and others. (2003). Ecological impacts associated with seismic exploration on the central arctic coastal plain. Final Report for ConocoPhillips Alaska, Inc., Anchorage, AK, by ABR, Inc., Fairbanks, AK, 76 p.

Yokel, D., and J. M. Ver Hoef. (2014). Impacts to, and recovery of, tundra vegetation from winter seismic exploration and ice road construction. (2014). BLM Arctic District, Fairbanks, AK, 61 p.

Information on vegetation, soils and permafrost impacts from Alaska DNR tundra travel modeling study 2003 - 2004:

This study developed a model to predict impacts of winter vehicle travel under different snow/freeze conditions and in different types of vegetation, in order to develop objective and easily measurable criteria for opening the tundra travel season. They tested different vehicle types on tundra in winter and the following summer recorded variation in soil temperature, soil depth to permafrost and photosynthetically active radiation absorption on the resulting tracks and control plots. Changes to these variables were minor, but did vary by vegetation types and did decrease as winter progressed. In the subsequent validation study they tested a disturbance ranking system more similar to those used in the three studies cited above. This showed that vegetation damage and surface depression did occur during the early winter dates tested and decreased greatly at later dates, related to greater snow density and deeper soil freeze. It also showed more impacts from vehicles with greater pounds per square inch.

Bader, H. R., and Guimond, J. (2004). Tundra Travel Modeling Project. Alaska Dept. of Natural Resources, Division of Mining, Land and Water. 65 p.

Bader, H. R. (2005). Tundra Travel Modeling Project: validation study and research recommendations. Alaska Dept. of Natural Resources, Division of Mining, Land and Water. 20 p.

Information on vegetation, soils, permafrost or wetlands impacts and recovery from seismic programs conducted in Alaska in the past 15 years (2002 to present):

No published papers and no in-house reports found yet, either from state or federal lands.

For 2-B and 2-C (above):

Known issues with infrastructure in the production phase include habitat loss from gravel pads and roads, habitat fragmentation due to long linear structures (roads), alteration of surface hydrology, thawing of permafrost and ground ice, introduction of non-native species and road dust effects on plants. Summaries are given in these documents.

National Research Council. (2003). *Cumulative environmental effects of oil and gas activities on Alaska's North Slope*. National Academies Press.

Raynolds, M. K., Walker, D. A., Ambrosius, K. J., Brown, J., Everett, K. R., Kanevskiy, M., ... & Webber, P. J. (2014). Cumulative geoecological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. *Global change biology*, *20*(4), 1211-1224.

- **What are key information gaps?**

For 1)

Vegetation maps: There is a great deal of descriptive information on vegetation and its relation to physical factors but no detailed high-accuracy map exists. The 1994 map of 1002 area had a measured accuracy of 52% for 18 vegetation classes. The age and low accuracy make this map inadequate for planning of industrial operations or stipulations on vehicle routing.

Soils, permafrost and wetlands maps: To date data have been collected to increase our knowledge of general landscape processes at a broad scale. These data do not meet the accuracy or resolution required to develop infrastructure or manage this remote landscape in conjunction with industrial use. No detailed high-accuracy maps exist for soils, permafrost or wetlands. Maps have been developed from limited or old data with little field validation and at scales lacking enough detail to effectively facilitate exploration, development, and restoration.

More information is needed on the seasonal soil freeze/thaw and snow pack/melt cycles in the 1002 area to determine stipulations for opening and closing the tundra travel season.

For 2-A) To predict and manage impacts from new seismic exploration in the 1002 area and design appropriate stipulations and mitigation measures, we need to know how impacts would be different from the substantial impacts documented in papers and reports about seismic

programs conducted on the North Slope between 1984 and 2001. Current NEPA documents for seismic programs state that impacts will be negligible due to improvements in technology, much less than those documented earlier, but we have found no follow-up studies or data to be able to evaluate this. We particularly need information from current or recent exploration in hillier terrain since those areas are more similar to terrain in the 1002 area.

For 2-B & C) Development beyond the seismic exploration stage in 1002 area would probably follow the trajectory of the Alpine Field or another newer field, rather than the older Prudhoe Bay field. We need information on the history and current status of these fields.

- **What studies/surveys need to be conducted to fill those information gaps?**

For 1) A database of geographic information for the 1002 area is needed. Layers would include:

New vegetation map.

Updated wetlands map

Soils map with field validation at a 1:63,000 scale

Map of permafrost characteristics and depth of soil active layer

Topography from most recent DEM

Terrain sensitivity map, modeled using the above layers

Cost estimate $1,500,000 – $3,000,000. Field validation for vegetation, soils, permafrost and wetlands could occur at the same time.

For 2-A) Studies of impacts and recovery from seismic exploration currently occurring on North Slope are needed. Do a literature search for draft or in-house documents regarding any follow-up done after seismic exploration conducted on the North Slope in the past 15 years. Information about exploration in hillier terrain would be most useful. Cost estimate: staff time only, but requires work by staff from multiple agencies.

For 2-B & C) Summary of history and current status of Alpine oil field or other newer oil fields on North Slope. Cost estimate: staff time only, but requires work by staff from multiple agencies.

Arctic Refuge 1002 Visitor Use Technical Report

Discipline/Subject Area: Visitor Use

Lead facilitators: Jennifer Reed, Arctic Refuge (907) 455-1835; and Tracy Fischbach, FWS RO Refuges (907) 786-3369

Individuals contacted: Roger Kaye, Wilderness Discipline/Subject Area Lead; Hollis Twitchell, Subsistence Use Discipline/Subject Area Lead; Steve Berendzen, Arctic Refuge Manager; Tom Bickauskus, BLM State Lead for Recreation, NLCS, NHST and W&SR

What do we need to know and why regarding subjects?

Definition of "Visitor": The term "visitor" includes any non-local person who takes part in recreation activities on the Refuge.

What and Why: Understanding current characteristics of visitor use (amount, type, timing, and distribution of visitor activities and behaviors), and visitor experiences (perceptions, feelings, and reactions that a visitor has before, during, and after a visit to an area) is essential to evaluating, and possibly minimizing, the effects of oil and gas development and infrastructure upon visitors, and commercial operators that support those visitors. However, because management of the Arctic Refuge has not required visitor registration or field contacts, information about what, where, and how visitor activities occur is limited.

Effects of highest concern on visitor opportunities and experiences include:

- Changes in opportunities for immersion in the area's wild character; its freedom from the human intent to control, alter, or manipulate its components and ecological and evolutionary processes.
- Changes to desirability of the destination (visitor displacement resulting from new user types; and/or increased visitation by new user types).
- Changes to the timing or availability of access for recreation (both consumptive and non-consumptive uses).
- Changes to the distribution of visitors, possibly leading to crowding.
- The emergence of new behaviors, modes of travel, or activity types, possibly leading to social conflicts.
- Reduced scenic opportunities due to changes to apparent naturalness by the addition of man-made structures.
- Reduced auditory quality due to addition of man-made noise to the natural soundscape.
- Reduced quality of night sky visibility due to atmospheric light pollution.
- Reduced opportunity for solitude. Solitude coincides with the Refuge CCP where it is defined as being free of the reminders of society, its inventions, and conventions. Solitude is greater than just being isolated from other people.

- Reduced opportunities for immersion in undeveloped area void of permanent structures or modern human occupation. Changes to levels of visitor satisfaction resulting from changes in overall quality of recreational opportunities.
- Changes to the quality of visitor experience could affect demand for commercial services among the majority of guide and air transporting businesses.
- Changes to the frequency of commercially-supported services may further limit managers' capacity to deliver quality visitor opportunities, since managers rely heavily upon the interests of commercial service providers to act as our eyes, ears, and workforce to deliver services.

What information is currently available to address the information needs for subjects?

Known Access Points/Routes used for Primitive/Unconfined Recreation: There are multiple areas and/or routes of known historic interest and sensitivity to visitors of the Coastal Plain:

- The historic caribou calving ground areas in May and June;
- Known caribou migration viewing areas allowing reasonable access in June and July including the following unimproved landing areas: Jago Bitty, Lower Marsh Creek, Lower Canning River; Kataktuiruk River, Aichilik River;
- Known abundant and diverse bird sighting areas include the Kaktaktuiruk River and Canning River delta June-July;
- Routes from the Neruokpuk Lakes Complex through the Arctic Coastal Plain from March until September (includes spring ski touring);
- The route stemming from the Sadlerochit Mountains along the Kataktuiruk River to Brown Low Point
- Canning River due to its non-technical rating and floatability all summer June until September (flow); whereas the Hulahula and Kongakut are experiencing lower water levels than historically seen (Hulahula receives high winds all winter and is a "scour point" so lower water and less floatable than past);
- Coastal lagoons between Hulahula River and Kongakut River, providing paddling access to Kaktovik during open water, from June through October; and,
- Coastal Lagoons which are Marine Protected Areas in the fall from July until freeze-up (recently mid-late October) for polar bear viewing.
- Packrafting routes including Upper Marsh Fork to Kaktovik; Arctic Village to Kaktovik; Neruokpuk Lakes Complex to Kaktovik; and Turner River to Kaktovik, with resupplies at major river crossings.

Two known reports on Visitor Use:

Arctic Refuge. 2011. Arctic National Wildlife Refuge Public Use Summary

This report, based on available indirect visitor data obtained through commercial client use reporting, and analyzed through 2009, provides a summary of historic visitor use information compiled for the area now designated within the Arctic National Wildlife Refuge boundary (up to 1997); depicts a general index of recent visitor use patterns (1998-2009) based upon available data; summarizes available harvest data for general hunting and trapping through 2009; and discusses current trends in public use with implications for future management practices.

Christensen N. and L. Christensen. 2009. Arctic National Wildlife Refuge Visitor Study: the characteristics, experiences and preferences of Refuge visitors
This report summarizes data directly collected from visitors and shows that:

- The greatest positive influence on visits came from experiencing the components of "Wilderness" (92%), "A Sense of Vastness" (92%), "Remoteness and Isolation" (89%), "A Sense of Adventure" (84%), and 'Natural Conditions" (84%).
- Refuge purposes most frequently rated as "Very Important" were "Wildlife"(97%), "Wilderness"(96%), "A bequest to future generations"(89%), "Remoteness and isolation"(89%), and 'A place where natural processes continue"(86%).
- Respondents encountered an average of two other groups on their trip, saw or heard four airplanes, and saw an average of one site with evidence of previous visitor use.

What are key information gaps?

- Baseline information on most of the concerns listed above as "Effects of highest concern on use opportunities and experiences."
- River floating, one of the main river activities, requires adequate flow. There is limited information about the Refuge's most-visited rivers.
- Fishing is a secondary activity enjoyed by many visitors who float the Refuge's rivers; the extent, to which fishing on the Canning and Hulahula Rivers occurs, among other Coastal Plain destinations, is unknown.
- There is no information about the number of people who visit the Refuge without using commercial services or about what activities they participate in.
- Client Use Reporting (CUR) by commercial air transporters does not provide consistent data about transported visitors' specific access areas and no data is requested for egress areas; therefore, there is no trip length data available from reports. CUR also does not include visitor's primary activity.

What studies/surveys need to be conducted to fill those information gaps? Please include duration (start and end), staffing and cost estimates.
<u>Ongoing efforts that could be focused or modified to meet needs:</u>

- Evaluate existing OMB-approved FWS visitor surveys for generalized information about Alaska Region's visitation patterns and preferences (duration: XX; lead: Natalie Sexton/Debbie Steen?; cost: XX).
- Re-evaluate 2009 visitor survey data held by Neal Christensen, to identify any possible additional information about experience condition expectations of visitors, specific to the Coastal Plain (duration: 3 months after contracted; lead: Jen Reed?; cost estimate: $10K?)
- Repeat/focus Arctic Refuge Visitor Survey to obtain current data about expectations of visitors, specific to the Coastal Plain (warning: dependent upon OMB approval) (duration: lead: XX, cost estimate: XX).
- Evaluate Refuge's raw 2010-2011 Client Use Report (CUR) data, consistent with previous data, to identify additional information specific to the Coastal Plain; and of Refuge's limited 2012-2017 CUR data (reporting requirements inconsistent with previous

data). (duration of effort: 6 months; lead: Reed; cost estimate: $3K for contracted database support).

<u>New efforts that are short-term priorities, since baseline data currently does not exist:</u>

- River flow data (duration: XX, lead: XX, cost estimate: XX).
- Viewscape baseline study (including visible pollution plume resulting from air quality affecting viewscape) to document visual resource conditions and potential future changes to existing undeveloped viewshed (duration of sampling: March-Oct, lead: XX, cost estimate: XX).
- Soundscape baseline study to document auditory resource conditions and potential future changes to existing natural sound environment (duration of sampling: March-Oct, lead: XX, cost estimate: XX).
- Night sky baseline study to document auroral, stargazing, and other astronomical resource conditions and potential future changes to existing night sky opportunities (duration of sampling: March-Oct, lead: XX, cost estimate: XX).

What management actions could be conducted to fill some information gaps?

- Require air transporters to obtain primary visitor activity by unguided but transported (plane or motorboat) visitors.
- Require primary access locations to be reported as lat/long.
- Develop a voluntary registration system for non-guided, non-commercially transported visitors.

Water Resources

Lead facilitators:

Greta Burkart, Aquatic Ecologist, Arctic National Wildlife Refuge & Alaska Refuges Inventory & Monitoring Program; US Fish & Wildlife Service, Greta_Burkart@fws.gov, 907-750-7067

John Trawicki, Water Resources Branch Chief, National Wildlife Refuge System, Alaska, US Fish & Wildlife Service, John_Trawicki@fws.gov, 907-786-3474

Individuals contacted:

Randy J. Brown, Fisheries Biologist, US Fish & Wildlife Service, Randy_J_Brown@fws.gov, 907 456-0295

Jeff Conaway, Branch Chief, Hydrologic Monitoring & Investigations, USGS Alaska Science Center, JConaway@usgs.gov, 907-786-7041

Richard Kemnitz, Hydrologist, BLM, rkemnitz@blm.gov, 907-474-2225

Margaret Perdue, Water Quality Specialist, Water Resources Branch, National Wildlife Refuge System, US Fish & Wildlife Service, margaret_perdue@fws.gov, 907-786-3421

Alan Peck; Soil, Water, & Air Program Lead; Bureau of Land Management, State Office, KPeck@BLM.gov, 907-271-4411 **What do we need to know and why?**

The Alaska National Interest Lands Conservation Act (ANILCA) explicitly directs the U.S. Fish and Wildlife Service to ensure water quality and quantity for the conservation of the natural diversity of fish, wildlife and their habitats:

(i) to conserve fish and wildlife populations and habitats in their natural diversity……

(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.

Winter seismic and other oil exploration activity will involve temporary infrastructure and withdrawals of large volumes of water that could have substantial short-term or long-term impacts to hydrology, water quality, fish and wildlife populations, and habitats. Development and production will involve even larger water withdrawals, gravel extraction from floodplains for permanent infrastructure, and generation and storage of hazardous wastes. These practices will result in increased potential for contamination, alteration of surface and groundwater hydrology, and additional impacts to fish and wildlife habitat.

To ensure legal mandates are met during exploration and development and allow for science-informed impact assessments, NEPA processes, best management practices (BMPs), and permit stipulations the following information is necessary:

- Identification of high-value and vulnerable aquatic habitats and critical hydrologic processes by season to ensure sufficient water is available to meet refuge mandates.
- Evaluation of the efficacy, applicability and transferability of BMPs, permit stipulations and mitigation measures used in the NPR-A for use on the coastal plain, 1002 area (per National Research Council (NRC) 2003) for all phases of industrial activity (seismic, exploration, development, restoration). This evaluation must recognize and understand the implications of the stark hydrologic and topographic differences between the coastal plain, 1002 area and areas with ongoing development:
    - Water covers 20.2% of the developed area in NPR-A, but only 1.6% of the coastal plain, 1002 area where large expanses of land are nearly devoid of lakes (figure 1).
    - Most lakes in the coastal plain, 1002 area are isolated from major drainages with limited recharge and may be more vulnerable to water withdrawals.

- Most flowing waters in the coastal plain, 1002 area are alluvial mountain streams.
- Groundwater-fed springs are unique to the coastal plain, 1002 area and provide critical habitat for extraordinarily high concentrations of invertebrates and overwintering fish.
- The relatively steep terrain and lack of water in the coastal plain, 1002 area will make it necessary to employ alternative untested practices.

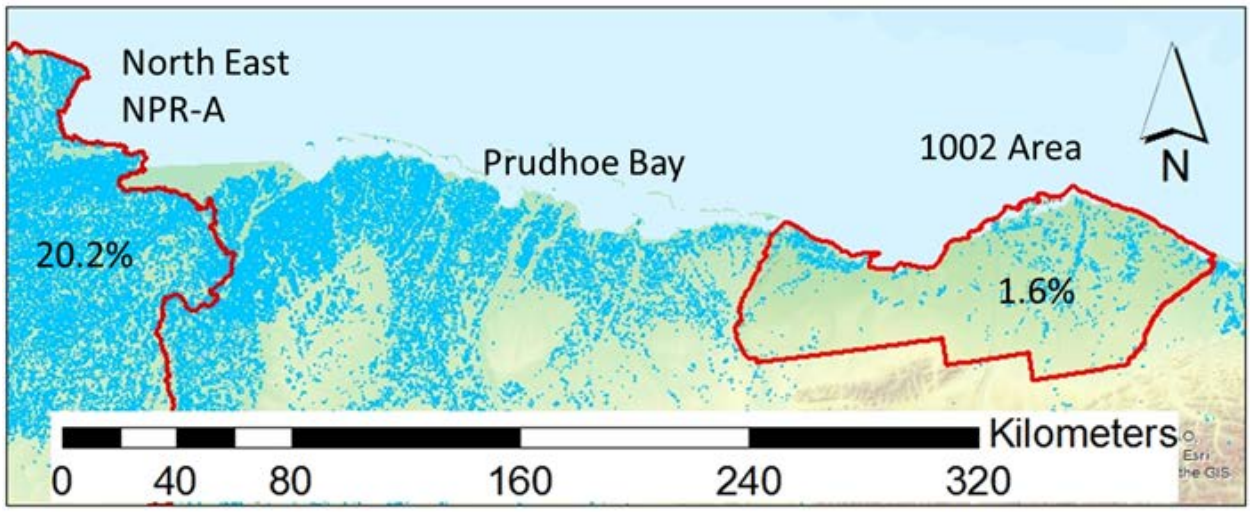


Figure 1. Surface water extent in the coastal plain, 1002 area and north eastern NPR-A planning area.

What information is currently available to address the information needs?
Most water resource studies were conducted nearly thirty years ago and include the following:

Rivers:

- Continuous hydrologic monitoring: five-plus years for three large rivers (USGS 2018) and four-plus years for seven smaller rivers during the open water season (Lyons and Trawicki 1994). The longest and only ongoing monitoring is on the glacier-fed Hulahula River (2011-2018).
- Quantity of liquid under ice hummocks in large rivers during winter (Lyons and Trawicki 1994)
- Limited water quality and channel geometry: Single sampling event for a limited suite of parameters on 11 streams and rivers (Childers et al. 1977)
- Documentation of fish: Sensitive species have been documented in all major rivers
- Groundwater springs: Reconnaissance inventory of spring locations with limited data on hydrology, macroinvertebrates, chemistry and aufeis extent (Childers et al. 1977)

Lakes:

- Water quantity (one-time sampling events):
  - Bathymetry and winter water availability of 115 of the largest lakes (Trawicki et al. 1991)
  - Elevation of lakes and marginal wetlands of 150 of the largest lakes (Bayhas 1996)
- Water quality: Summer sampling of 36 small lakes (Synder-Conn and Lubinski 1995), late fall sampling of 7 large lakes, and late winter sampling of one large lake (Childers et al. 1977).
- Fish:
  - Reconnaissance surveys targeting nine spine stickleback identified stickleback in 34 of 52 lakes surveyed (Trawicki et al 1991). More intensive surveys of 22 lakes documented nine spine stickleback in 10 lakes and more sensitive species in 6 lakes (Wiswar and others).

A Remote sensing inventory identified lakes of sufficient depth to support overwintering fish (Grunblatt and Atwood 2014).

What are key information gaps?

Seismic and exploration will involve water withdrawals and temporary infrastructure. Prior to activities, the following questions need to be answered to allow for science-informed decisions:

- How effective are existing BMPs and mitigation measures used in the NPR-A at ensuring protection of habitat? Will they ensure protection of habitat in the coastal plain, 1002 area? According to the NRC (2003), these questions have not been answered.
- What habitats or areas need additional protection due to their vulnerability and/or high-value to fish, waterbirds, other wildlife, recreation, and subsistence?
- What is the status and natural variability in water quality and quantity of rivers and lakes? This information is necessary to allow for impact assessments and adaptive management practices.

During development, production and restoration phases, water use, alteration of surface and ground water hydrology and potential for contamination will increase. Prior to water withdrawals, drilling, leasing, gravel extraction, permanent infrastructure, injection of hazardous waste, and restoration the following questions need to be answered to allow for science-informed decisions:

- What BMPs, mitigation measures, and restoration standards will ensure protection of habitat from impacts of development in the coastal plain, 1002 area where there are considerable differences in hydrology, terrain, and management purposes compared to the NPR-A?
- How important are springs and associated aufeis and ice-dam flooding events in supporting fish and wildlife habitat and river recharge?

What studies/surveys need to be conducted to fill those information gaps?

Rivers and groundwater springs (figure 2):

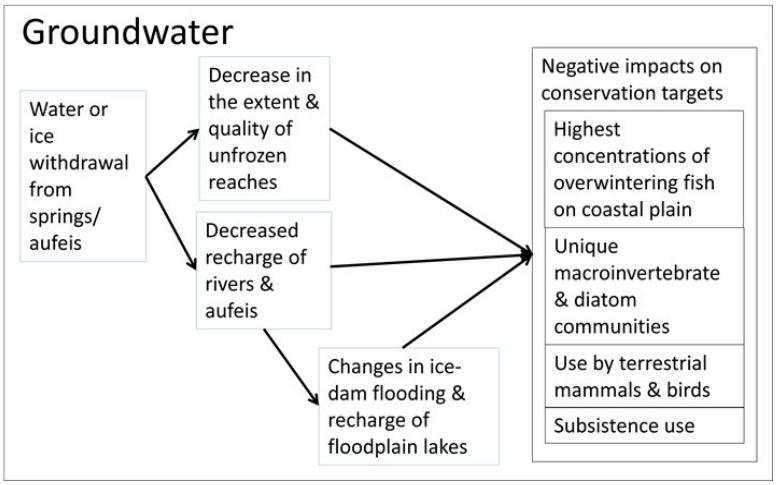


Figure 2. Adverse impacts of groundwater/ice withdrawals on fish, wildlife and subsistence.

Near-term and medium-term (starting FY18):

- Characterize seasonality in water quantity and quality to allow for science-informed NEPA processes and development of BMPs and permitting stipulations that ensure protection of fish and wildlife habitat and account for cumulative impacts of climate change. Conduct continuous water quality and quantity monitoring on the Hulahula, Tamayariak, and Canning rivers to evaluate the current status and natural variability in late fall and spring surface water quality

and quantity in relation to the timing of fish use and industrial activity (August 2018-2030: $175,000 per year, potential leads USGS, USFWS, BLM).

- Identify the extent and value of groundwater to delineate special areas and support science-informed NEPA processes, BMPs, and decisions regarding hazardous waste disposal that ensure protection of fish and wildlife and habitat:
    - Evaluate groundwater flow paths and recharge -- Develop a conceptual groundwater model informed by isotopic studies to delineate and age flow paths. Quantify river recharge rates to inform water withdrawal permits in areas that are primarily recharged from groundwater. (FY18-20 total cost: $$, potential leads: USGS and USFWS).
    - Identify open-water areas and aufeis-associated fish habitat and evaluate terrestrial mammal use of aufeis, aufeis contributions to late summer flows, and the importance of aufeis and ice-dam flooding in recharging fish and wildlife habitat in the Canning, Hulahula, Itkilyariak, Katakturak, and Sadlerochit river drainages (FY18/19 costs: $, USFWS and USGS).

Medium-term (starting FY19): seismic, development, production and restoration phases

- Evaluate efficacy of current practices and applicability to the coastal plain, 1002 area to support science-informed NEPA processes, BMPs, and restoration plans that ensure protection of fish and wildlife. Considerations must include effects on sheet flow, ice-dam flooding, and recharge of floodplains and differences between the coastal plain, 1002 area and the NPR-A.
    - Identify and conduct studies to minimize impacts of gravel extraction and infrastructure
    - Identify and conduct studies to ensure adequate restoration

Lakes (figure 3):

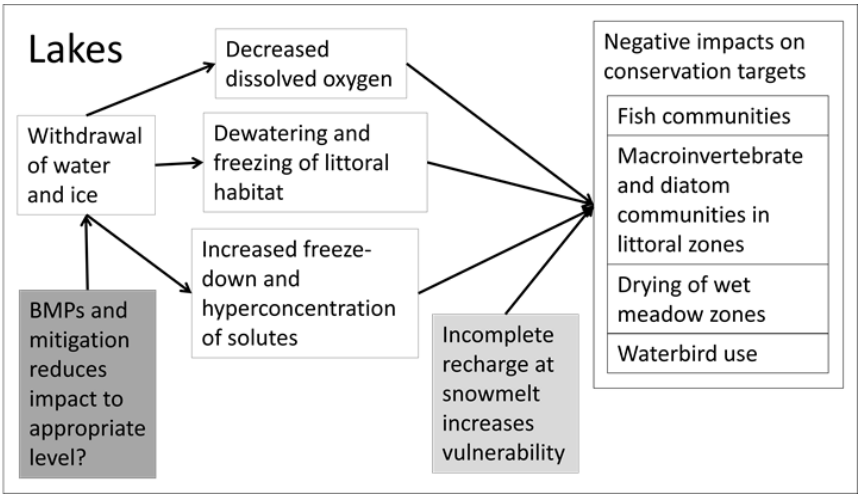


Figure 3. Adverse impacts of lake water and ice withdrawals on fish, wildlife and habitats.

Near to medium-term:

- Identify high-value and/or vulnerable lakes and characterize seasonality in water quantity and quality to allow for science-informed NEPA processes and development of BMPs and effectiveness monitoring protocols that ensure protection of fish and wildlife habitat with a known level of confidence (FY18-22 cost: $$, leads: USFWS, USGS, BLM).
    - Fish surveys have only been conducted in 2.3% of lakes in the 1002 area and most surveys were brief reconnaissance surveys only targeting nine spine stickleback. Fish distribution models and sample collection protocols have been developed for other

areas on the North Slope, but their applicability to the 1002 area is unknown. Macroinvertebrate diversity is an indicator of ecosystem health and has never been assessed in 1002 area. Baseline contaminants surveys of fish have only been conducted at a small handful of sites. To identify high-value aquatic habitats, inform planning, and provide baseline samples there is a need to document fish presence; test the applicability of existing fish survey protocols and distribution models, and collect baseline macroinvertebrate, fish e-DNA, and fish tissue samples to archive for future analysis (for more information, see resource assessment for contaminants). Results would include the following: traditional fish surveys in up to 60 lakes, validation of protocols and fish distribution models for applicability in the 1002 area, baseline macroinvertebrate and fish contaminant samples collected in up to 60 high-priority lakes, and e-DNA samples available to test for fish presence in up to 200 lakes. Refuge staff and two arctic fisheries biologists can conduct this field work in FY18. (FY 18 cost: $76,150, FY19 cost: $82,000, Lead: Greta Burkart, John Trawicki, Phaedra Budy, Angela Matz, Sandy Talbot, Damian Menning, and Robert Gerlach) Develop geospatial inventory of hydrologic connectivity, watershed areas and relative snowpack to assess lake vulnerability/recharge potential (FY18-20, leads: USGS, USFWS). Integrate this effort with surveys of snow pack (see resource assessment for snow and climate) and updates of the national wetland inventory updates (see resource assessment for wetlands) and national hydrography dataset.

    - Continuous water level and winter water quality monitoring on representative lakes to evaluate current status and natural variability relative to timing of potential impacts of industrial activities and use by fish and wildlife (FY18-22, leads: USFWS, USGS, BLM).

- Evaluate efficacy of current practices and applicability to coastal plain, 1002 area to support science-informed NEPA processes and BMPs that ensure protection of fish and wildlife.
    - Assessments of the adverse impacts of water withdrawal on lake biota in the NPR-A are necessary to assess the efficacy of existing BMPs (per National Research Council 2003). Comparing aquatic macroinvertebrate diversity in the NPR-A on 6 untapped lakes and 6 lakes where the entire permitted volume has been withdrawn and the vulnerability is similar to a range of lake types in the coastal plain 1002 area (FY18-19 costs: $80,000, potential leads: BLM, USFWS, USGS) will help assess the efficacy of existing BMPs. This effort would require 5 field days and could be conducted by the Arctic Refuge aquatic ecologist with assistance from BLM in identifying potential study lakes that are vulnerable to water withdrawals and have had permitted volumes withdrawn. Estimated costs for FY18 or 19: $63,480 (sample analysis by contract lab: 41,000, five days of field food: $230, helicopter and fuel: $21,850). Note the cost would be $10,000 cheaper and the project would have a lower carbon footprint if a helicopter already based on the North Slope is used. The power to detect change in macroinvertebrate community composition is unknown, but could at least be estimated if this study were conducted. If additional funds were available surveys of the following could be conducted as well: wet meadow zones, recharge rates, and winter water quality.

Geospatial:

Near-term:

- Cross reference existing technical reports to map any known areas of special values including Wild and Scenic Rivers, springs, subsistence use areas, and recreational areas (e.g. Canning River takeout). Identify data gaps in our knowledge in addition to those mentioned previously.

Medium-term:

- Develop NHDPlus High Resolution hydrography framework, which extends the hydrologic network seamlessly across the terrain by including not only streams and lakes, but also associated catchment areas that drain to each lake or stream segment. This association allows information about the landscape to be related to the drainage network. Observational data on the drainage network, such as water quality samples, stream gauge measurements, or fish distribution, can be linked to the framework, integrating data and facilitating analyses required during all phases of exploration and development. This effort should be combined with wetland and vegetation surveys (see resource assessment for wetlands and vegetation).

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updated 1Mar2018jwm

From: Shelden, Stephan
To: Arthur, Stephen
Cc: Hollis Twitchell
Subject: Re: fuel for caribou surveys
Date: Wednesday, May 2, 2018 7:10:01 PM

Stephen,

Currently we are well situated with fuel in Arctic village and Galbraith with somewhere in the neighborhood of 1200 gallons at each location. If we are successful with the Peter's Lake resupply, there will be a similar quantity of AVgas as is staged at Jago Bitty. We have not left a pump at Jago and anyone using that source will need to bring a pump with them. Pumps are available and locked up in the shop building at Perter's lake for use there. That equipment should remain at the Peters Lake location.

Please keep us informed of actual usage at any of the locations so that we are familiar of what we can depend on as available and resupply needs.

On Wed, May 2, 2018 at 2:49 PM, Arthur, Stephen <stephen_arthur@fws.gov> wrote:

> I talked with Jason from ADFG about fuel needs for caribou surveys. It seems likely that the Jago strip will be too wet for Dennis to land there in early June. The next best option might be Peters Lake, assuming the ice is still ok for landing. As I understand it, you are planning to stage some fuel there as well, is that true? Otherwise, they may operate out of Arctic Village (last year the Kavik strip was also unusable in early June). Is there much fuel left at Arctic?
>
> I'm guessing the caribou will be calving in the foothills bordering the southern edge of the 1002, roughly centered around the Jago, unless snowmelt goes very quickly this month, in which case they will be further north on the coastal plain. Probably very few will be east of the Kongakut or west of the Hulahula.
>
> Also, is there a pump with the fuel at the Jago?
>
> Stephen M. Arthur, Ph.D.
> *Supervisory Wildlife Biologist*
> *Arctic National Wildlife Refuge*
> *101 12th Ave., Room 236*
> *Fairbanks, AK 99701*
> *(907)455-1830*

From: Berendzen, Steve
To: Roger Kaye; Stephen Arthur; Joanna Fox; Hollis Twitchell
Subject: Fwd: FW: 1002 Area Seismic feedback from LK @kenai
Date: Friday, May 4, 2018 11:07:51 PM

FYI - a vote of confidence for Roger's suggestion b5-dp [redacted] I think we should discuss among ourselves prior to this next meeting what we think b5-dp [redacted]

Steve Berendzen
Refuge Manager, Arctic National Wildlife Refuge
907-456-0253

---------- Forwarded message ----------
From: **Wendy Loya** <Wendy_loya@fws.gov>
Date: Fri, May 4, 2018 at 1:52 PM
Subject: FW: 1002 Area Seismic feedback from LK @kenai
To: Steve Berendzen <steve_berendzen@fws.gov>, Joanna Fox <joanna_fox@fws.gov>, Stephanie Brady <stephanie_brady@fws.gov>, Tracy Fischbach <tracy_fischbach@fws.gov>, Mitch Ellis <mitch_ellis@fws.gov>, Doug Damberg <doug_damberg@fws.gov>, Bud Cribley <bud_cribley@fws.gov>
Cc: Lynnda Kahn <lynnda_kahn@fws.gov>

Hi 1002 team,

Forwarding some thoughts from Lynnda, that we should probably discuss with Sarena Sweet at BLM, who would likely consult with the solicitor about…

Depending on the timing of the next joint Seismic meeting, we can discuss how to approach either next Weds at 1pm or via email.

Thank you Lynnda, we are grateful for you to continue to share your experience in this new-to-Arctic project.

Wendy

Dr. Wendy M. Loya, Coordinator

Office of Science Applications -Arctic Program

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

From: Kahn, Lynnda <lynnda_kahn@fws.gov>
Sent: Friday, May 4, 2018 1:45 PM
To: Wendy Loya <wendy_loya@fws.gov>; Mitch Ellis <mitch_ellis@fws.gov>
Cc: Andy Loranger <andy_loranger@fws.gov>; Stephen Miller <stephen_a_miller@fws.gov>
Subject: 1002 Area Seismic

Hi Wendy and Mitch, b5-dp [redacted]

[redacted]

[redacted]

[redacted]

Below are a few other little things I thought of during the teleconference --

b5-dp [redacted]

b5-dp

[redacted]

[redacted]

[redacted]



From: Burkart_Greta
To: Stephen Arthur; Christopher Latty; Roy Churchwell; Jorgensons
Subject: Various species lists
Date: Monday, May 7, 2018 7:18:57 PM

Hi -- Chris and Steve mentioned interest in pulling together existing species lists so I thought I would mention these if we are compliling list:

Arctic Refuge species ranked vulnerable to climate change by Defenders of Wildlife: https://defenders.org/sites/default/files/publications/climate_change_and_the_arctic_national_wildlife_refuge_which_species_are_most_at_risk.pdf

Rare plants on the North Slope: https://blm-prod.opengov.ibmcloud.com/documents/national-office/blm-library/report/rare-vascular-plant-species-north-slope-alaska-review

Link to conservation maps and definitions used to classify conservation ranks for species throughout Alaska (created by Alaska Natural Heritage Foundation): http://accs.uaa.alaska.edu/conservation-rank-definitions/

Outdated (2013) AK Natural Heritage list of sensitive species based on BLM, USFWS, and State of Alaska lists: http://climatechange.lta.org/wp-content/uploads/cct/2015/03/All_Tracking_Lists_18March2013.pdf

BLM Alaska species list: https://www.blm.gov/programs/fish-and-wildlife/threatened-and-endangered/state-te-data/alaska

Shorebird species expected to be at increasing risk of extinction due to climate change: http://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0108899&type=printable

Does anyone have the up to date USFWS priority species lists for Region 7 or the priority species list the Refuge came up with? Dave Payer was working on the Coastal Plain as a priority landscape - I am not sure what that led to.

Greta Burkart, PhD
Aquatic Ecologist
US Fish and Wildlife Service
Arctic National Wildlife Refuge and Alaska Refuges Inventory and Monitoring Program
101 12 th Ave Rm 236
Fairbanks, AK 99701
ph: (907) 456-0519
fax: (907) 456-0428
email: greta_burkart@fws.gov
www.facebook.com/arcticnationalwildliferefuge

From:	Fox, Joanna
To:	Roger Kaye; Jennifer Reed; Hollis Twitchell; Stephen Arthur; Christopher Latty; Burkart, Greta; Joshua Rose; Alfredo Soto
Cc:	Steve Berendzen
Subject:	Fwd: FW: EA
Date:	Tuesday, May 8, 2018 2:30:40 PM
Attachments:	20171220 FINAL DRAFT EA Arctic 1002 Regulation Proposed Rule forwared to HQ and AKSOL.docx

Here is the draft EA Steve and I referred to this morning. It was developed for the proposed rule change last fall, and may be a good template for you to use as you start drafting Affected Environment portions of the EA for seismic activity. Because it was a draft and never finalized, please do not distribute this document in its current format beyond this office.

Thank you,
Joanna

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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www.facebook.com/arcticnationalwildliferefuge

"Do what you can, with what you have, where you are." -- Theodore Roosevelt

---------- Forwarded message ----------
From: **Wendy Loya** <Wendy_loya@fws.gov>
Date: Mon, May 7, 2018 at 12:29 PM
Subject: FW: EA
To: Joanna Fox <joanna_fox@fws.gov>, Steve Berendzen <steve_berendzen@fws.gov>

Please read Stephanie's email below regarding the attached EA for the Rule Change from last fall. It was for a different purpose than a seismic permit and was not final, but has relevant information to help with the SAE application.

From: Brady, Stephanie <stephanie_brady@fws.gov>
Sent: Wednesday, May 2, 2018 9:01 AM
To: Wendy Loya <wendy_loya@fws.gov>
Subject: Fwd: EA

Here is the last version that I have - please do not distribute further. This was never completed so it is still in draft form. Stephanie

stephanie_brady@fws.gov | Branch Chief, Conservation Planning and Policy |

U.S. Fish and Wildlife Service | National Wildlife Refuge System | Alaska |

907.306.7448

https://sites.google.com/a/fws.gov/alaska-region-office-of-conservation-planning-policy/home (DOI employees)

PREDECISIONSAL NOT FOR PUBLIC RELEASE

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

20 December 2017

0000004853

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 exploratory activity 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 1002 area of the coastal plain within Arctic National Wildlife Refuge (Arctic Refuge). The proposed action would remove the date restrictions now in place for submission of exploration plans for exploratory activities, and more closely aligns oil and gas exploratory activities with comprehensive and continuing inventory and assessment of the fish and wildlife resources within the coastal plain of the Arctic Refuge. The proposed action would provide applicants the opportunity to submit requests to the Service for new surface geological and seismic exploration exploratory activities s in the 1002 area, and thereby reassess the oil and gas potential under the terms and conditions stipulated under ANILCA and existing regulations. The Service would review new applications for exploratory activity for completeness and environmental protections, review annual plans of operations, and issue special use permits (SUPs) which would include project specific stipulations to decrease the impact of these activities. After SUPs are issued, the Service would monitor field activities and plan closeouts.

If the regulation is changed to allow exploratory activity plans to be submitted and SUPs to be issued, it is expected that surface geological and seismic exploration would occur in the 1002 area of Arctic Refuge. This activity would expand the human-presence in this area of the Refuge beyond 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. Today, oil and gas exploratory activities strive to minimize surface disturbances and occur primarily during winter months (December to May) when most wildlife is absent, or otherwise less active.

Due to the requirement for Federal agencies to comply with the National Environmental Policy Act (NEPA) for approval of actions affecting Federally-administered lands and/or resources, additional environmental review is required through NEPA for each proposed exploratory activity. This review of proposed exploratory activities would include development of general BMPs and project specific stipulations that would ensure these activities do not significantly adversely affect fish and wildlife, their habitats, or the environment.

0000004854

Glossary of Terms Used

1002 area	The portion of the Arctic Refuge's coastal plain identified on the map entitled *Arctic National Wildlife Refuge* (August 1980) and described in 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).
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
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 seismic exploration 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 Mammal 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
North Slope	Defined as all lands in the State of Alaska north of the Brooks Range divide.
NRC	National Research Council, National Academy of Sciences
NRPA	National Petroleum Reserve-Alaska (administered by BLM)
Refuge coastal plain	Defined as all lands within the Arctic Refuge north of the Brooks Range divide.
ROD	Record of Decision, Federal agency decision that concludes an EIS

ROP	Required operating procedure, as applicable to lease conditions for exploratory 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	Stormwater 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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Appendix A. ANILCA Section 810 Subsistence Analysis for the Proposed Amendment to Regulations for Geological Exploration of the Coastal Plain 1002 Area 98

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 to conduct surface geological and seismic exploration on the Arctic National Wildlife Refuge (Arctic Refuge) lands described in the Alaska National Interest Lands Conservation Act (ANILCA) § 1002. Because the allowable area of these exploratory activities within Arctic Refuge are described in ANILCA § 1002, this area has become known as the "1002 area." The 1002 area is part of Arctic Refuge's coastal plain spanning from the Canning River to the Aichilik River and as far inland as the Brooks Range foothills (Figure 1).

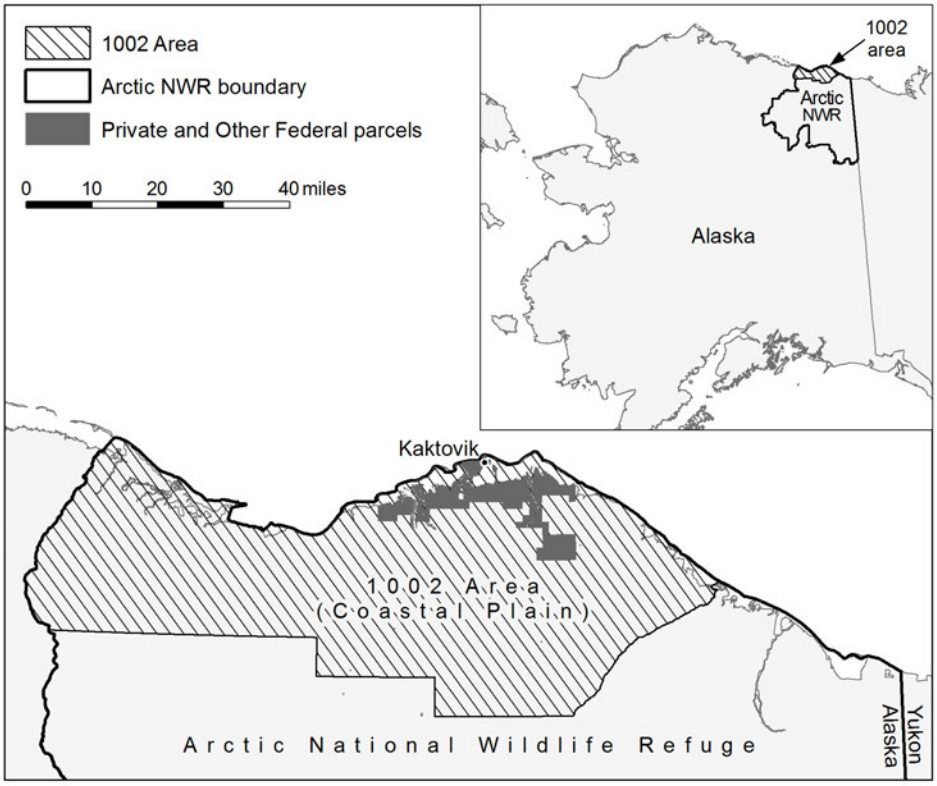


Figure 1. Arctic National Wildlife Refuge showing the coastal plain 1002 area (based upon the original map included with the authorization of ANILCA, dated August 1980).

The proposed regulatory change does not itself authorize any on-the-ground activities or compel the issuance of any particular activity; 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. More specific analyses would be developed when reviewing individual applications for exploratory activity. In addition, pursuant to the terms of ANILCA § 1002, the Service is only authorized to allow exploratory activity in a manner that avoids significant adverse effects on fish, wildlife, and other resources.

As a result of this action, it is anticipated that there could be a number of successful applicants who would be allowed to conduct surface geological and seismic exploratory activities in order to collect new information on oil and gas resources within this area of the Refuge. This information would inform public policy decisions and further the goals described in Executive Order 13783 *Promoting Energy Independence and Economic Growth* and Secretarial Order 3352 *National Petroleum Reserve, Alaska*.

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)

Federal agencies are required by NEPA to consider the effects of their actions on the quality of the human environment, specifically those actions that may significantly affect 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) is being developed by the Service to consider the effects of this administrative action proposed by the Service. This EA does not evaluate decisions to issue SUPs for specific exploratory activity 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 exploratory activity 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)

When ANILCA was passed in 1980 the Act re-designated Arctic Refuge, established additional purposes, and required the writing of a Comprehensive Conservation Plan (CCP) (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 and as mentioned above is generally referred to as the "1002 area."

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. Proposed actions may also require negotiations regarding international treaty obligations with Canada for caribou. Federal requirements include 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.

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 would 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 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.

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.
- Service determinations under Section 106 of the National Historic Preservation Act.
- 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 Stormwater Discharges and Stormwater 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.

1.3 BACKGROUND

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, muskoxen, 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."

v) per pending statute, "to provide for an oil and gas program on the coastal plain".

In addition to expanding the Refuge and establishing its purposes, 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 Refuge 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 in this area 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 within the 1002 area (FWS 1982). Between 1982 and 1987 over 50 separate biological field studies 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 Refuge 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 Refuge 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; BLM 2016b).

Concurrent with the biological studies, oil and gas resource exploration and assessment were ongoing in the 1002 area of the Refuge 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 Refuge's 1002 area was potentially rich in oil and gas resources. Based on these findings, there was a 95 percent chance this 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. As a result, 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 described in ANILCA § 1002(d) include 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 1002 area of the Refuge, including: purpose and definitions [Subpart A]; general requirements for exploratory activities [Subpart B]; exploratory activity 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 of the Refuge during 1984-85, and recommended that 50 CFR §§ 37 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 of the Refuge (Werkheiser 2017).

b5 - dp/ac

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 exploratory activity 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 exploratory activity plans	October 1, 1984 – May 31, 1986	June 4, 1984

1.4 AGENCY AND PUBLIC INVOLVEMENT

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. If the Service determines that the proposed action will not result in significant impacts, the Service will 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). We have identified tribal governments

and ANCSA Corporations potentially substantially affected by the proposed rule change, who are being invited to consult with us 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 1-2 and the issue will not be discussed further in this EA. Issues being further evaluated are listed in Table 1-3. These issues will be further evaluated in Chapter 3 Affected Environment and Chapter 4 Environmental Consequences.

Table 1 - 2: 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 Refuge is within the breeding range of the Spectacled Eider (*Somateria fischeri*), and they only occur there as a rare breeder at very low densities. Steller's Eider (*Polysticta stelleri*) do not breed in the 1002 area of the Refuge 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

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	strategies to address environmental justice concerns in their approach to operations.
Visual	During exploratory activities (Dec-May), few people will be in the vicinity of the equipment. No equipment will be left after work is completed and any traces of activity, such as survey stakes and any trash will be removed upon completion of each exploration season.

Table 1 - 3: Issues Considered for Further Evaluation

AFFECTED ENVIRONMENT	REASON FOR FURTHER EVALUATION
Soils	Although the overall geology of the coastal plain 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, or the melting of permafrost leading to hollows in the ground. There is also a risk of fuel spills from equipment being used.
Water Resources, Hydrology and Wetlands	The 1002 area of the Refuge is a water-limited system. In any proposed winter exploration activity, 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 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 of ice roads and ice pads and other associated

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	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. Nests have been documented as early as March 23. Exploration activities are expected to last until early May, overlapping with Golden Eagles' nesting season.
Resident Birds	Gyrfalcons are rare breeders on the coastal plain, and like Golden Eagles, initiate nesting very early in the spring leading to possible conflicts with the exploration activities. The Gyrfalcons' primary late winter/early spring prey is rock and willow ptarmigan which are uncommon and common permanent residents, respectively, in this area.
Migratory Waterfowl & Shorebirds	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 1002 area of the Refuge 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 muskoxen and moose are now rare in this area and on the coastal plain in general; their populations have declined in recent years. Muskoxen 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 overlapping with expected seismic exploration activities.
Polar Bears	A majority of female polar bears of the Southern Beaufort Sea population den in the 1002 area of the Refuge in high densities. As a result much of the area has been designated

	critical habitat under the ESA. 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 construction of ice or gravel roads and pads, associated infrastructure, and seismic survey may cause direct effects to previously undocumented cultural resources.
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 activities.
Wilderness Values	The resulting exploration activities may result in a substantial level of activity 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 1002 area of the 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

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 then progresses in a manner that results in transect coverage over the entire identified area.

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 ever substituted for ice when developing the infrastructure, the gravel is cleaned and removed at the end of the season. 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 2016a)

Annual Timeframe Work Period	Proposed Activity
December 10	Scouting and early crew mobilization
January 10	Full crew mobilization
January 15	Begin seismic operations
April 25	Complete seismic operations
April 25- May 1	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 an improved understanding of the 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 April 19, 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 to avoid affects to resources during the same time and space exploration activities are occurring in order to decrease cumulative effects to those resources. For instance, winter activities allow crews to avoid effects to migratory birds that are only in the area during the summer months.

Potential negative effects 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 considered updating the environmental protection requirements of 50 CFR §§ 37.31 and 37.32, but determined that the regulations as currently written provide adequate and appropriate protection of refuge resources and allow the Regional Director to impose additional stipulations to ensure that permittees' activities are conducted in a manner which avoids significant adverse effects on the refuge's wildlife, its habitat, and environment

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 of the Refuge.

3 Affected Environment

Throughout this analysis and in Chapters 3 and 4 in particular, it is important to understand the geography of the lands being described. The 1002 area and the Arctic Refuge are both legally defined locations on the map. The coastal plain and the North Slope are geographic. Their boundaries are based on landforms and geographic characteristics. As noted above, the area now commonly called the "1002 area" is a portion of the coastal plain legally defined in ANILCA and in regulations. This area is only within the boundary of the Arctic Refuge between the Canning River to the west, the Aichilik River to the east, and the Brooks Range foothills to the south. The 1002 area does not cover the entire coastal plain. The coastal plain includes all the lands east of the Canning River and north of the Brooks Range foothills. It continues east beyond the 1002 area all the way to the Canadian border and beyond. The North Slope is a more general term that describes all the lands within the State of Alaska, regardless of ownership, that are north of the Brooks Range divide, hence the name "North Slope."

The coastal plain is characteristically different than other lands within the North Slope. To the west of the Canning River, the coastal lands widen as the Brooks Range dips south. Rivers meander across this vast flat landscape which has become dotted with numerous lakes and wetlands over the millennia. To the east of the Canning River, the Brooks Range remains relatively close to the coast line creating a sloped landscape where numerous rivers flow quickly to the Beaufort Sea creating steep banked rivers with few lakes. Although there are few lakes in

this area, the ground is generally wet because any moisture that falls cannot drain away due to the impermeable permafrost layer only a couple of feet down. This is discussed in more detail in Section 3.1.2 - Water Resources and Wetlands.

Per ANILCA § 1002(c), resource assessment baseline studies within the 1002 area of the Refuge 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, muskoxen, 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 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 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; BLM 2016b).

Since 1988, the natural and cultural resources, and lifestyles (including subsistence) in the Refuge, including the 1002 area, 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).

Resources on the coastal plain have changed since the mid-1980s (e.g., Clough and others 1987). The area is warmer and drier. (ACIA 2004; NRC 2008; IPCC 2014). Polar bear use and denning has increased substantially and is likely to continue to increase (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. More people are seeking out wilderness experiences and the increased number of polar bears coming ashore has created an opportunity for polar bear viewing.

Table 3-1. Convenience cross-reference for affected (existing) environment descriptions and factors.

Resource	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 Resources, Hydrology and Wetlands	13, 18-20	38-43
Vegetation	16-17	45-53
Wetlands	18	
Fish	34	62-78
Eagles and Raptors	33	85
Migratory Birds including waterfowl & shorebirds	32-33	79-83, 85-89, 92-93
Other Terrestrial Mammals	26-29	112-114

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Caribou	21-26	
Polar Bears	30	117-123
Bowhead Whale	--	
Seals	31	
Cultural Resources	45	132
Socioeconomics	35-45	145-173
Subsistence Resources	36-42	174-217
Noise	16	43-44
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)

3.1.2.1 Hydrology

Water resources in the 1002 area of the Refuge consist of streams, lakes, and springs. Streams 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 of the Refuge 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 1002 area of the Refuge, but are concentrated near the mouth of the Canning River and in the region of the Sadlerochit and Jago Rivers with very few lakes occupying the central Katakturuk River region (Trawicki 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 but still within the coastal plain, 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).

3.1.2.2 Streams and Rivers

The 1002 area of the Refuge 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, 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 measurable (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). The term “aufeis” is a German word which means “ice on top” and refers to areas where a sheet-like mass of layered ice has formed by successive flows of ground water during freezing temperatures.

Break up on the 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 rise 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. 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.

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. Because many of the glaciers feeding these streams are predicted to disappear within the next 50 years, stream connectivity is expected to be reduced negatively affecting fish who migrate between streams to find overwintering habitat (Nolan and others 2011). Surface water availability and instream connectivity may also decrease as the active layer on the coastal plain deepens from increased glacial sediment, and the summer season lengthens increasing evapotranspiration rates (FWS 2015a).

3.1.2.3 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 life in a changing climate.

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3.1.2.4 Lakes

The density of lakes in the Refuge 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).

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 to 7 feet (Bilello and Bates 1969, 1971, 1972, 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 pungitius*) was found in 34 of 52 lakes surveyed (65 percent) in 1989.

In the past 50 years, 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).

3.1.2.5 Winter-specific Hydrologic Data

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).

3.1.2.6 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).

3.1.2.7 Climate Change Effects to Water Resources and Wetlands

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 water bodies 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

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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 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.

The coastal plain 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 inches 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 Alaska statewide snow coverage in May 2016 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 coastal plain resulting from the Brooks Range acting as a barrier to moisture transport.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 Vegetation

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 lands 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*. 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 freshwater, 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 Refuge 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 Refuge 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 Dolly Varden, 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 6 to 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

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and Trawicki 1994; Schmidt and others 1989; Moulton and George 2000). This type of habitat is uncommon and a limiting factor to overwintering fish survival (Reynolds 1997). Large lakes are also uncommon in the 1002 area, and particularly rare are those with overwintering habitat. Overwintering habitat requires that the lakes does not freeze to the bottom during winter months, provides sufficient dissolved oxygen, and/or is 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. Dolly Varden are primarily anadromous but rely on freshwater habitats for spawning, early rearing, and wintering. Therefore, Dolly Varden also migrate with primary movement corridors in the Canning, Aichilik and Hulahula Rivers. The Canning River has the largest Dolly Varden 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). Dolly Varden is the most important subsistence freshwater fish species followed by Arctic grayling.

3.2.4 Golden Eagles

Golden Eagles (*Aquila chrysaetos*) are considered common visitors on the coastal plain and rare breeders on the inland coastal plain (FWS 2015a). Across the coastal plain, Golden Eagle numbers have increased at an annual rate of 7 percent between 1986 and 2012, and over the last decade of that period the increase was an annual rate of 37 percent (Stehn and others 2013). The average count of Golden Eagles over the entire period was 118 birds, but in 2012 a high of 522 birds were observed (Stehn and others 2013).

The 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 with nest sites observed within core caribou calving areas.

Within the Arctic Refuge, Golden Eagles begin nesting early in the 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).

3.2.5 Resident Birds

Four species of birds are considered permanent residents of the coastal plain: Willow Ptarmigan (*Lagopus lagopus*), Rock Ptarmigan (*L. muta*), Gyrfalcon (*Falco rusticolus*), and Common Raven (*Corvus corax*) (FWS 2015a). Gyrfalcons are an uncommon resident of the coastal plain (FWS 2015a), yet nests have been found in the 1002 area. Even in the middle of winter, Gyrfalcons may be present in 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, coastal plain and adjacent marine waters, 158 species of migratory birds 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 (*Branta* spp.), except Canada Geese (*B. canadensis*), and Tundra Swans (*Cygnus columbianus*) primarily breed on the coastal plain wetlands (FWS 2015a).

Red-throated Loons (*Gavia stellata*) 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-throated Loons 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 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 (*Calidris tenuirostris*), 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, muskoxen, moose, brown bear, wolf, and wolverine. Dall sheep (*Ovis dalli*) do not occur on the coastal plain. Among the five species which do occur in that region, both muskox (*Ovibos moshatus*) and moose (*Alces alces*) have experienced marked population declines over the last few decades. After muskoxen were reintroduced to the coastal plain 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 muskoxen 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 muskoxen 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 which produces nutritious forage. As a result, late winter is a time of high vulnerability (FWS 2015a).

Moose populations in northeast Alaska, including the Arctic Refuge, increased rapidly through the late 1980s, then from 1989 to 1994 moose in this region declined by at least 50 percent, leading to harvest closures on State lands. By the early 2000s, 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).

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Grizzly bears (*Ursus arctos*), wolves (*Canis lupus*), 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 do not reproduce until they are older (9 years of age in the Arctic Refuge), have an average litter size of 2, have 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 (*Rangifer tarandus*) 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.

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By August, large aggregations gradually disperse into widely interspersed smaller groups that move progressively toward winter ranges. Breeding takes place in 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 and for those that overwinter in that area, including members of the Teshekpuk Herd.

3.2.8.1 Porcupine Caribou Herd

An iconic symbol of Arctic Refuge, this herd migrates hundreds of miles from wintering grounds south of the Brooks Range 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. Pregnant 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 north westward 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 acres (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 1002 area than in areas further south and east (Jorgenson and others 2002).

3.2.8.2 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.

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.

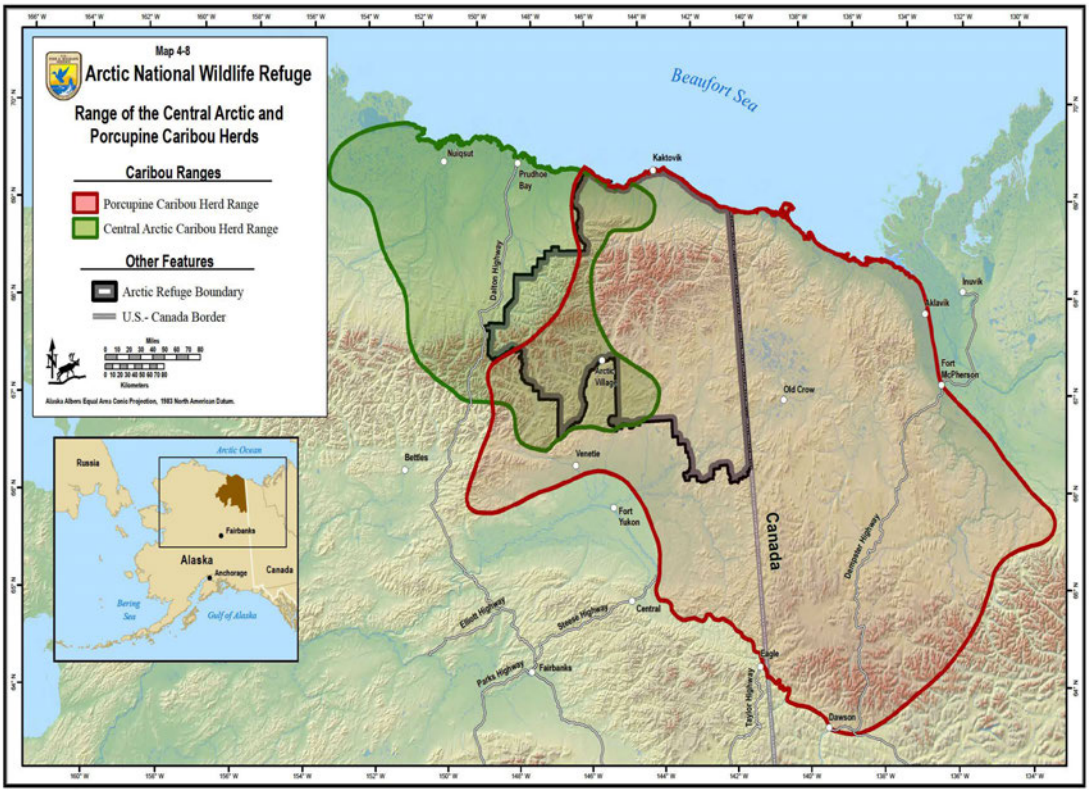


Figure 3.1. Caribou herd distributions in Arctic National Wildlife Refuge.

3.2.9 Polar Bear

Of the two polar bear (*Ursus maritimus*) subpopulations found in the U.S., polar bears in the Southern Beaufort Sea (SBS) subpopulation are the most likely to occur in the 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 1002 area 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). 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 1002 area (FWS 2009, 2010). There is 38 percent more denning habitat available in the 1002 area than in the region immediately to the west (Durner and others 2006). Polar bears have been shown to den in the 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 1002 area (Durner and others 2010). Therefore, the 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 1002 area as managed under the current Arctic Refuge CCP of minimal management (FWS 2015a, 2105b). In effect, the ITR assumes the 1002 area will remain undeveloped and provide undisturbed habitat resources for polar bears.

3.2.10 Bowhead Whale

The bowhead whale (*Balaena mysticetus*) 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 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 others 1982; Mel'nikov and others 1997; 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 easily altered 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 others 2010b). 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 western 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 (*Pusa 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*) 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 the extent of 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 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). Although it is known that people have used this area for millennia, especially along the river corridors and the coastline, exact locations of artifacts and/or historic or cultural sites are generally unknown.

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 these communities' proximity to and use of the Porcupine caribou herd.

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

Demographic Characteristic	Arctic Village	Chalkyitsik	Cold-foot	Fort Yukon	Kakto-vik	Venetie	Wise-man	Prud-hoe 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	N/A	$33,194 +/- $7,432	$58,125 +/- $33,478	$28,333 +/- $21,379	N/A	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 by-products 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.

3.3.4.1 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 residents of 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 their heavy reliance on this resource, 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 sheep and caribou, which contribute 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 foothills. 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 popular and the hunt is open year round. No permit statistics were available to quantify the extent of caribou hunting.

Individuals exploring the area either on foot or by floating the rivers may also spend time fishing for Dolly Varden or other fish species. Fishing season is open year-round, but limits have been set by species for lakes and flowing or salt waters.

In recent years, polar bear viewing on Refuge waters adjacent to the community of Kaktovik has become a growing tourism activity (FWS 20015a, 2015b).

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 - 3: Noise levels (dBA).

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.

3.3.7 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. The area also 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

The disclosure of environmental impacts associated with the alternatives including the No Action Alternative is required by NEPA. 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 (Chapter 3). 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 analysis of each specific proposal would be necessary in order to fully understand and document any effects to the quality of the human environment as required under NEPA.

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.

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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.

4.3 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.

4.4 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 of 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.

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Golden Eagles	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 Gyrfalcon 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: 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 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, muskoxen 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.

4.5 ALTERNATIVE 2 - 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, but as described at the beginning of Chapter 3 Affected Environment, there are significant topographic differences between the NPRA and the 1002 area. Namely, the NPRA is mostly flat while the 1002 area is sloped from north to south with steeply banked rivers cutting into the surface periodically across the area.

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, especially along river banks, 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 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 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 can cause melting of the permafrost, 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).

4.5.2.1 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, 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.

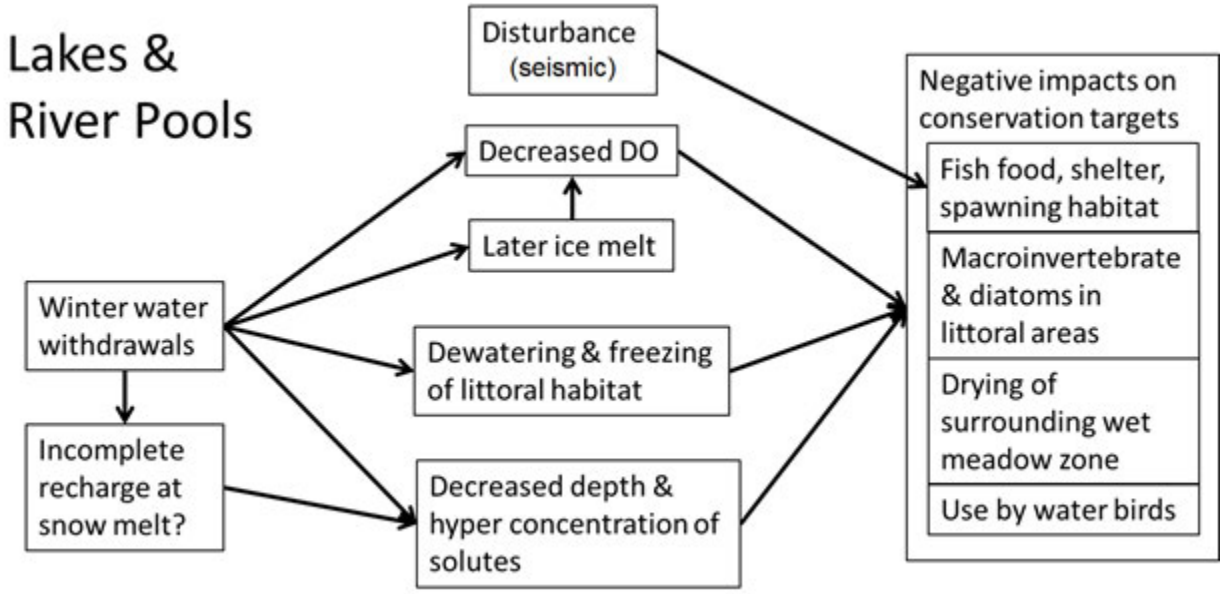


Figure 4.1 Potential impacts of seismic exploration on lakes and rivers

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.

4.5.2.2 Effects on Wetlands

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.

4.5.2.3 Effects of Ice Roads, Ice Pads and Ice Bridges

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 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 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 coastal plain, 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, but continued warming and drying of the coastal plain may create additional stressors to natural resources in the area.

4.6 ALTERNATIVE 2 – 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 crosses uneven ground, but these sites are generally more resilient and quicker to recover (Jorgenson and others 2010). The NPRA Integrated Activity Plan/EIS (BLM 2012) indicates that in general, construction of ice roads, pads, and airstrips, and 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 with implementation of 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 to vegetation is not the seismic surveys but the development and movement of the supporting infrastructure that 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).

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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.

4.6.2 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.

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.

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Impact Summary: Minor to moderate.

4.6.3 Golden Eagles

Golden Eagles are common in the 1002 area, and may remain on or near nesting territories through the winter. Because their nesting 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), BMPs, ROPs, and SUP stipulations would be needed to reduce the possibility of disturbance. In studies elsewhere, disturbance and human activities were correlated with reduction in Golden Eagle nesting success (Kochert and others 2002; Watson 2010). It may be assumed that winter seismic activity could have similar effects for Golden Eagles in the 1002 area if appropriate measures are not taken.

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

4.6.4 Resident Birds

Ptarmigan and Gyrfalcon are known to be present within the 1002 area during the winter (Platt 1976). Gyrfalcons, like Golden Eagles, are early-nesting birds that could be disturbed by exploratory activities occurring near their nest during April and May. Gyrfalcons are known to elicit strong defensive behavioral responses to fixed- and rotary-winged aircraft especially near occupied breeding sites (Booms and others 2008). Disturbed birds are also 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 exploratory 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 individual nesting pairs' territories or nesting efforts in close proximity to late spring exploration activities or seasonal demobilizations.

4.6.5 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.

4.6.6 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.

0000004917

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.

4.6.7 Caribou

Caribou of the Central Arctic, Teshekpuk and Porcupine herds may be present in the 1002 area throughout the year**.** 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 be 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 pregnant 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.

4.6.8 Polar Bears

Compared with other areas of the 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 reasonably 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 increasingly place polar bears and human activities in conflict.

Polar bears present in the 1002 area may be affected by exploration through a variety of ways. Noise, vibrations, sights, and smells produced by seismic survey and staging 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 for 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.

Although exploration activities have been intentionally planned to decrease effects to wildlife, it is anticipated that staging activities may occur in late fall to prepare for a winter exploration season. The nearest community to the 1002 area is Kaktovik which is also a known gathering place for polar bears prior to sea ice development. An increase in the number of flights and activities within this community could create additional stress to polar bears that are in a particularly vulnerable part of the year, after experiencing a period of prolonged fasting.

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 (FWS 2016c). 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 plain 1002 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 CFR § 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 (50 CFR § 37.31(b)(10)) and the prohibition on the use of explosives within 1/2 mile of any denning polar bears (50 CFR § 37.31(b)(11)). The exclusion zone for polar bear dens is now

1-mile under 50 CFR § 18.128 (FWS 2016c). Additionally, 50 CFR § 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.

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.

Impact Summary: Moderate with incorporation of potential conservation measures and other permit terms and conditions: due to the higher density and habitat preference of polar bears for the 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.

4.6.9 Bowhead Whale

Bowhead whales would generally only be affected if exploration activity includes shipping via 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.

4.6.10 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

What is known about the prehistoric and use of the coastal plain is generalized from ethnographies and cultural resources investigations of areas adjacent to 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 of work crews. It is expected that exploration activity personnel would be experienced operators from outside the area.

Impact Summary: Minor.

4.7.3 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 may have the potential to damage snowmachines used by local subsistence users who are traveling throughout the area hunting and fishing. The winter exploration activities may also force some hunters to travel farther and/or into less familiar territory in order to avoid the exploration activities.

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) and 50 CFR§§ 37 exploration activities would be subject to terms and 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.

4.7.4 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, but 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.

4.7.5 Noise

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 dramatic 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, muskoxen, and polar bears.

Impact Summary: Generally negligible, but localized minor impacts may occur. Noise may have an effect for individuals near exploration activities, particularly caribou, muskoxen and polar bears.

4.7.6 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 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

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.*

Although the actual modification of the 50 CFR §§ 37 to allow the submission of surface geological and seismic exploration would have no direct effect to any resources, the assumed indirect effect is that one or more exploration plans would be approved and exploratory activities would occur in the 1002 area. Depending on the number of exploratory activities occuring in any given year, the cumulative effects could be amplified beyond what is described here. The Service assumes that over time exploratory activities will occur across the entire 1002 area.

Before analyzing this proposed action, it is first helpful to understand the baseline condition of the 1002 area prior to the exploratory activities that occurred from 1984-1986. Prior to 1984, there had been no industrial activity in this area. Subsistence activities such as hunting, fishing, berry picking, and the human movements across the landscape that supports these activities had been happening for millennia, although the mode of transportation changed over time from dog sleds to snowmachines in winter and sail and paddle boats to boats with outboards motors in summer. Few people ventured to the Refuge for recreational purposes as the lands were difficult to access and there were few commercial guides to support those who did want to explore the area. During this time, winters came early (September) and stayed late (June) with bitter, long lasting cold throughout. Polar bears were not listed as Threatened under the ESA and multi-year sea ice was prevalent in the Beaufort Sea. Vegetation was without signs of human disturbance and caribou, fish and other wildlife species were unaffected by human actions, besides for limited subsistence hunting and fishing by the few residents of the area and the rare sport hunter and fisher.

In 1983, the Service began accepting applications for exploratory activities in the 1002 area with exploration occurring from 1983 to 1986, as described in Section 1.3. Although no permanent change to wildlife species were detected from these activities, long term changes to vegetation are still noticeable. Following are aerial views of a trail made in winter 1985 across moist sedge-willow tundra. The first photograph is from July 1985. The second photo is from July 2007, 22 years later. As a result of the "cat train," the ground was compressed, and the permafrost melted creating a hollow which creates a wetter and subsequently greener trail. The "greening" is a result of the vegetation changing from the moss-dominated tundra like the surrounding area into a strip dominated by sedges.



Figure 5-1. Photo taken July 1985, after exploratory activities, in the Arctic 1002 area.



Figure 5-2. Photo taken July 2007, 22 years after exploratory activities in the Arctic 1002 area.

The following map based on a 1985 USGS report shows the impact lines from the early exploratory activities. The two dots show the locations of the above photographs.



Figure 5-3. Maps of Seismic Lines from Work Completed in 1984 and 1985.

A general description of modern exploratory activity is included in Section 2.2. The analysis in this section describes cumulative effects that may occur as a result of approved exploratory activities in addition to other activities or changes occurring on the landscape. Per ANILCA requirements, exploratory activities are not to be duplicative in order to decrease the effects to natural and cultural resources in the 1002 area. With that in mind, the Service does not expect to approve multiple exploration plans for any single area, but anticipates approving multiple exploration plans that cover the entire 1002 area.. The following table shows those resources that may be affected not only by exploratory activities, but also by other activities or changes on the landscape.

Table 5-1. Summary of Anticipated Additional Contributors for Analysis

	Subsistence Use	Recreation Activities	Sea Ice Loss	Warming Temps	Lingering Effects from Prior Exploratory Activities
Soils & Vegetation				X	X
Water				X	
Dolly Varden & Arctic Char	X	X (Fishing)		X	
Caribou	X	X		X	
Polar Bears	X	X (Wildlife Viewing)	X		

5.1 CUMULATIVE EFFECTS TO HABITAT

As noted above, affects to soils and vegetation that continue to persist from earlier exploratory activities have continued to persist over time. –Although new technology and 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), BLM continues to see lingering effects to vegetation from the sled-mounted camp facility\ies. In addition, 3-D seismic work, which is the goal of the proposed exploratory activity, requires transects that are significantly closer together than transects used in the 1980s. Source lines, or the transect line where the energy is emitted, may be as close as 550 feet. These camp facilities can house up to 150 personnel working 12-14 hour shifts 24/7 with tracked

vehicles, snowmachines, planes and helicopters used for support. Although the camp facility would not travel the same source lines; therefore dispersing the effects further apart than 550 feet, the Service anticipates that the camp facility will leave its own mark upon the landscape through possible thermokarsting and resulting vegetation change similar to that seen from the work in the 1980s.

These past and anticipated changes to vegetation may be exacerbated by a warming climate on the North Slope. Temperatures here are predicted to rise 7°C, or 12°F, by the end of the century increasing the likelihood of additional permafrost melting which can either lead to hollows in the ground which then fill with water or allow for water held at the surface to drain away. In either case, the vegetation type changes. Changing of vegetation does not happen immediately, but over time as the old vegetation dies from either too much water or too little water and new plant species better suited to this new microenvironment colonize. During this time, these areas would be particularly susceptible to the introduction of invasive plant species, another known stressor on the landscape. Protocols have been developed to try and avoid introducing invasive plant seeds or rhizomes, but it is nearly impossible to catch every seed from every boot tread, bag, and equipment track.

Related to possible changes to soils and vegetation, is the change to water resources. As mentioned above, thermokarsting is a known concern when disturbing tundra environments dominated by permafrost. Thermokarsting can lead not only to small hollows in the ground, but can also lead to lake drainages. The Permafrost Laboratory at the University of Alaska Fairbanks reported in 2010 that lake drainage rates were 1-2 lakes/year and that these drainages may be caused by surface permafrost melting and human disturbances among other factors. As noted in Section 3.1.2, the 1002 area is a water limited system with few lakes. Any changes to lakes could have effects to fish, vegetation and other resources.

5.2 CUMULATIVE EFFECTS TO FISHERIES

In Section 4.6.2 Fisheries, the possible effects to Dolly Varden and Arctic Char if exploratory activities are allowed in the 1002 area were described. In addition to these possible effects, Dolly Varden and Arctic Char are also fish species of primary importance to subsistence fishers in this area and a target species for recreational fishers. According to the Community Subsistence Information System data from 2002, the latest data available, over 40% of the households in Kaktovik, harvested these species for subsistence use. In this year, an estimated 2,649 Dolly Varden were caught and 2,849 Arctic Char. This is similar to the harvest rate of Arctic Char in 1985 (3,075 fish). No data was available for Dolly Varden in 1985. It is unknown what the current harvest level is of these two species.

These species are also a target species of recreational fishers to the area. According to ADF&G sport fish harvest data for the North Slope area (which is significantly larger than the 1002 area), an average of 620 Arctic Char/Dolly Varden were harvested. ADF&G does not differentiate

between the species in the sport fish harvest data. ADF&G describes North Slope fish species as slow-growing which can support only minimal harvests. That said, the remoteness of this area keeps the level of harvest pressure low. It is anticipated that subsistence and sport harvest of these species will continue in future years, but there is no indication that these activities will have a measurable additive effect to those listed in Section 4.6.2 Fisheries.

5.3 CUMULATIVE EFFECTS TO MAMMALS

Caribou have long been a targeted species for subsistence and recreational hunters. Subsistence use is described above in Section 3.3.4.1. The 1002 area lies within Alaska GMU 26C. According to the Alaska State Hunting Regulations for 2017-18, Alaska resident hunters may take 10 caribou annually. Any caribou may be taken between July 1 and April 30. Bulls only from June 23 to June 30. Nonresident hunters are limited to 2 bulls taken between August 1 and September 30. The latest ADF&G harvest report for this area was for the years 2006-2007. They report a 5 year harvest average between 2002 and 2007 of 55 animals from the Porcupine caribou herd, and 687 animals from the Central Arctic caribou herd. Like the fisheries, the remoteness of this area keeps the level of harvest pressure low. It is anticipated that subsistence and sport harvest of caribou will continue in future years, but there is no indication that these activities will have a measurable additive effect to those listed in Section 4.6.7 Caribou.

Of greater effect to caribou will be changes to their habitat caused by changing fire regimes and the resulting change in vegetation. It is predicted that the Porcupine caribou herd will lose 21% of winter habitat to fire by the end of this century, with the majority of this loss driven by increased flammability in spruce forests in the Yukon (Gustine and Others 2014). It is anticipated that this loss of wintering grounds may change the winter distribution of the Porcupine Caribou Herd.

A description of the potential effects of exploratory activities and sea ice loss are described in Sections 3.2.9 and 4.6.8. Polar bears are legally harvested by coastal dwelling Alaska Native peoples under the Marine Mammal Protection Act, but the harvest rates are very low (less than 5 per year). No sport hunting is allowed within the United States.

A few polar bears have always come to shore near Kaktovik because of the shallowness of the coastal waters which draw concentrations of seals, polar bears preferred prey; but in recent years with the loss of sea ice bears are congregating near this community as described in Section 3.2.9. As a result of this congregating of polar bears, a wildlife viewing tourism industry has grown. Kaktovik is unique in that the coastal waters surrounding the community are part of the Refuge. In 2010, the Refuge permitted the first commercial polar bear viewing guides to operate on those waters. Their activities are highly regulated in order to ensure no effects to polar bears occur. For instance, guides are prohibited from using any baits or approaching the bears in such a way as to change the bear's behavior. In 2011, there were 200 visitors. This increased to 400 visitors in 2012 and in 2016 there were 1,200 visitors. It is anticipated that subsistence harvest and

recreational viewing of polar bears will continue in future years, but there is no indication that these activities will have a measurable additive effect to those listed in Section 4.6.8 Polar Bear.

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 effected, 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 an 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 dredged 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 withdrawal 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 Service staff. The Service holds final responsibility for all content. Personnel for each contributing party are listed in Table 7-1.

Table 7.1 Preparers, Contributors, and Advisors

Contributing Party	Personnel	Title
FWS	Tracy Fischbach	Natural Resources Planner, Region 7 Division of Natural Resources
FWS	Ryan Wilson	Wildlife Biologist, Region 7 Marine Mammals Management
FWS	Christopher Putnam	Wildlife Biologist, Region 7 Marine Mammals Management
FWS	Wendy Loya	Coordinator, Arctic Landscape Conservation Cooperative
FWS	Brian McCaffery	Wildlife Biologist, Region 7 Division of Natural Resources
FWS	John Martin	Wildlife Biologist, Region 7 Division of Natural Resources
FWS	Margaret Perdue	Hydrologist, Region 7 Division of Natural Resources
FWS	John Trawicki	Hydrologist, Region 7 Division of Natural Resources
FWS	Edward DeCleva	Archaeologist, Region 7 Division of Visitor Services
FWS	Greta Burkhardt	Hydrologist, Region 7 Division of Natural Resources

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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 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**
December 10	Scouting and early crew mobilization
January 10	Full crew mobilization
January 15	Begin seismic operations
April 25	Complete seismic operations
April 25- May 1	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.

From:	Fox, Joanna
To:	Roger Kaye; Jennifer Reed; Stephen Arthur; Burkart, Greta; Christopher Latty; Hollis Twitchell; Joshua Rose; Alfredo Soto
Subject:	Meeting today to discuss seismic application
Date:	Tuesday, May 8, 2018 2:52:36 PM

If you're available at 2:30 today, please plan to participate in a 1-hour brainstorming session to start thinking about what additional information BLM needs to ask the seismic activity applicant to provide for the evaluation of their proposal in the EA.

I have reserved the Arctic Refuge conference room for this discussion.

Thank you!
Joanna

_____
Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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www.facebook.com/arcticnationalwildliferefuge

"Do what you can, with what you have, where you are." -- Theodore Roosevelt

From:	Berendzen, Steve
To:	Hollis Twitchell; Reed, Jennifer; Paul Banyas; Stephen Arthur; Christopher Latty; Soto, Alfredo; Roger Kaye; Wiese, Wilhelm; Joanna Fox
Subject:	Fwd: DUE COB Thursday 5-10 Fwd: Updated briefing paper on Arctic NWR Infrastructure needs
Date:	Wednesday, May 9, 2018 8:24:59 PM
Attachments:	Alaska Infrastructure Proposals May 2018 Information Memorandum Template.docx

Greetings,

A short-turnaround fire drill for info on the use of Kaktovik and Galbraith facilities. Please review what Doug sent us, and provide feedback to Joanna and me by noon tomorrow (Thursday).

We need to demonstrate the shared use of facilities and equipment; this could be a critical factor in the determination of whether to support this funding request, so we should include everything. For bunkhouse usage, this should include cooperators such as what Ken Dunton's crew intends to do this year as well as cooperating researcher use in recent years. We also need to ensure we include all agency use including our own agency use by Marine Mammals and OLE staff. We'll probably want to provide numbers in the way of an "annual use example", but go back a few years to capture the maximum usage per year for different agencies/ entities.

State partners and their contractors (i.e. Dennis Miller or others) should not be overlooked, and this would apply to both Kaktovik and Galbraith Lake. I don't know if State Troopers or other state employees use either of these facilities, but if there is occasional use by collaborators, that should be included.

As far as equipment storage or sharing of our equipment goes, please do your best to remember any examples of this (BTI pickup, boats?) Do we haul partners around in aircraft or boats? If so, we should mention that.

I don't know if Hollis will be back in the office early enough to offer his recollections on this usage, so I'd appreciate it if all who can reply will either check with Joanna and me or other staff to ensure everything you know about is included. If there's redundancy, we can likely figure that out and eliminate duplicates.

Steve Berendzen
Refuge Manager, Arctic National Wildlife Refuge
907-456-0253

---------- Forwarded message ----------
From: **Damberg, Doug** <doug_damberg@fws.gov>
Date: Wed, May 9, 2018 at 4:50 PM
Subject: DUE COB Thursday 5-10 Fwd: Updated briefing paper on Arctic NWR Infrastructure needs
To: Steve Berendzen <steve_berendzen@fws.gov>, "Fox, Joanna" <joanna_fox@fws.gov>
Cc: Mitch Ellis <mitch_ellis@fws.gov>

Steve/Joanna:
I'm going to need some help answering Greg's questions in relation to our $4M Construction

request. Greg Sheehan will be talking to the Deputy Secretary about the proposal and will need concrete examples of how we cooperate with other agencies in the context of sharing/using our facilities. Can you provide your best estimate for:

1. how many nights other agencies spend in our Kaktovic or Galbraith Lake facilities (break out by location)
2. do we provide any storage (seasonal or otherwise) for other agencies in Kaktovik or Galbraith Lake? And/or are there known needs that we currently can't help with?
3. do we store our own equipment that we then assist others with anything such as boat rides to Barter island for USGS geology work, or State of AK for Caribou survey work?
4. Have we had any discussions with other agencies or the State about expected use if we do expand the facilities? Or, are you generally aware their needs?
5. Are there other examples of sharing facilities or equipment with other agencies (fed or state) at Arctic Refuge that are not captured above?

We do not need an exhaustive list, but we need to be able to speak to some things we are currently doing and what our expectations are moving forward. There are some outstanding examples of sharing at our Kaktovik bunkhouse (and in turn, the vehicle, boats, etc.) that will highlight the idea concept and how much need/demand already exists, let alone as things ramp up.

I attached the updated version of the BP to provide a little more background - although you've seen most of this already.

Can you please send a response directly to Greg with a cc to Mitch and I by COB tomorrow (May 10th)?

Thanks so much for your help - I will be on the road tomorrow but reachable by cell if you want to talk about this in more detail.
d

Doug Damberg
Refuge Supervisor, AK North Zone
U.S. Fish and Wildlife Service
1011 E. Tudor Rd.; Anchorage, AK 99503
Office: (907) 786-3329
Cell: (907) 947-6302

---------- Forwarded message ----------
From: **Greg Siekaniec** <greg_siekaniec@fws.gov>
Date: Wed, May 9, 2018 at 3:51 PM
Subject: Re: Updated briefing paper on Arctic NWR Infrastructure needs
To: "Damberg, Doug" <doug_damberg@fws.gov>
Cc: Mitch Ellis <mitch_ellis@fws.gov>, Socheata Lor <Socheata_Lor@fws.gov>, karen_clark@fws.gov

Thank you Doug. After having a discussion with Greg Sheehan and his expectation that he will be answering to Deputy Secretary we should have some concrete examples of how we cooperate. Can we estimate how

many nights other agencies spend in our facilities, do we provide any storage (seasonal or otherwise), do we store equipment that we then assist others with (boat rides to Barter island for USGS geology work), or State of AK for Caribou survey work? Have we had any discussions with other agencies or the State about expected use if we do expand the facilities? Greg would like to have something to speak to about how we cooperate in and around our facilities and what we might do after expending 4m in construction funding.

Thank you,

Greg

Sent from my iPad

> On May 9, 2018, at 1:54 PM, Damberg, Doug <doug_damberg@fws.gov> wrote:
>
> Mitch asked if I could update our Arctic Refuge infrastructure briefing paper. If you have any additional questions, please let me know.
> d
>
> Doug Damberg
> Refuge Supervisor, AK North Zone
> U.S. Fish and Wildlife Service
> 1011 E. Tudor Rd.; Anchorage, AK 99503
> Office: (907) 786-3329
> Cell: (907) 947-6302
> <Alaska Infrastructure Proposals May 2018 Information Memorandum Template.docx>

Information Memorandum for the Regional Director

Date: May 5, 2018

DTS DCN #: NA

From: Mitch Ellis, Chief of Refuges – Alaska, National Wildlife Refuge System

Telephone #: 907-786-3667

Subject: Region 7 Refuge Program Infrastructure Needs (Construction)

I. Introduction

The 2018 FY 2018 House Omnibus Appropriations Bill directed the Service to provide a spend plan to the Committees within 120 days for the additional $50 million allocated in deferred maintenance (construction) funding. Infrastructure needs at Arctic NWR support the December, 2017 Tax Cuts and Jobs Act's (H.R. 1) new Refuge purpose for oil and gas development that requires two oil and gas lease sales on the coastal plain (the first within 4 years).

II. Background

Kaktovik, Alaska on the Beaufort Sea is the critical base of operations for Arctic NWR for activities north of the Brooks Range including in the 1002 Coastal Plain. Arctic Village and Galbraith Lake also serve as important bases for operations to support activities in the Coastal Plain. The Refuge maintains a bunkhouse, garage, and mobile fuel tank to support aviation, marine, and community-based activities in Kaktovik. The Refuge has a small bunkhouse (cabin) at Galbraith Lake. Meeting H.R. 1's mandate will require additional support infrastructure for all agencies involved with implementation as activities ramp up. All Service facilities would continue to be shared with other Federal agencies, particularly the BLM, in addition to State partners. There have been broad, general discussions between agency partners about operational needs and support infrastructure as this program develops. Additional detailed discussions will follow as design plans are developed. The total amount for these needs is estimated at 4 million. Specific Project details include:

1) **Kaktovik storage building (~1.8 mil):** Arctic Refuge's Kaktovik storage space is currently limited to a small single door garage. Additional storage space is needed to secure and protect vehicles, boats, motors, tools, building material, and other supplies that support operations.

2) **Kaktovik aviation fuel tank facility (~ 317k):** Arctic Refuge currently fuels aircraft using a mobile tank (100 gallon tank in the bed of a pickup truck). The Refuge needs a larger capacity fuel tank with modern safety and containment features. A 2,500 gallon double wall fuel tank with attached pumping system should be located proximal to a hangar facility for safety and ease of operations.

3) **Arctic Village bunkhouse (~1.8mil):** Arctic Village airport serves as an important staging area for many activities on the Refuge including in the 1002 area. A small scale bunkhouse compatible with village norms would increase efficiencies of operations in the 1002 area as well as improve relations with the Native community. Arctic Village is strategically located on the south side of the Brooks Range and serves as an important access route to the 1002 area when weather in Kaktovik precludes any flights in and out.

4) **Galbraith Lake vault toilet (~160k):** Galbraith Lake cabin and fuel tank also serve as an important staging location for Refuge activities on the North Slope and in the 1002 area. The existing dry cabin has no water or toilet facilities. This location is strategically located north of the Brook's Range along the Dalton Highway and also serves to provide access to the North Slope and 1002 area when weather in Kaktovik precludes any flights in or out.

III. Positions of Interested Parties

There is strong interest from the Department and elected officials supporting implementation of the oil and gas development in the 1002 area of Arctic Refuge.

IV. Potential Issues/Conflicts



V. Communications and Outreach

Outreach Lead:	Mitch Ellis Chief of Refuges – Alaska, NWRS.
Affected States:	Alaska.
Media POC:	Sara Boario Assistant Regional Director-External Affairs 907-786-3431.
Congressional:	Informational only at this point. TBD.
State Contacts:	Informational only at this point. TBD.
Other Outreach:	Local outreach will eventually be conducted with Tribes and communities.

Conversation Contents

Fwd: 1002 Seismic Discussion

"Lemons, Patrick" <patrick_lemons@fws.gov>

From:	"Lemons, Patrick" <patrick_lemons@fws.gov>
Sent:	Wed May 09 2018 14:54:40 GMT-0600 (MDT)
To:	"Conn, Sarah" <sarah_conn@fws.gov>
CC:	Christopher Putnam <Christopher_Putnam@fws.gov>, "Colligan, Mary" <mary_colligan@fws.gov>, Drew Crane <drew_crane@fws.gov>, Ted Swem <ted_swem@fws.gov>, Bob Henszey <bob_henszey@fws.gov>
Subject:	Re: 1002 Seismic Discussion

Hi Sarah et al,

I just got off the phone with Mary and it looks like we're on for 3pm this afternoon. The call-in information is below. Let me know if you have questions. Talk to you in a bit.

Call-in Number: b5-conf
Passcode: b5-conf

Patrick

On Wed, May 9, 2018 at 10:34 AM, Conn, Sarah <sarah_conn@fws.gov> wrote:

> Hi Patrick,
>
> We are available either of those times although 3pm today would be preferable.
>
> Thanks,
>
> Sarah
>
> On Wed, May 9, 2018 at 10:01 AM, Lemons, Patrick <patrick_lemons@fws.gov> wrote:
>
> > Hi Sarah,
> >
> > Mary asked that I setup a meeting with your office and our regulatory program to discuss the planned seismic survey in the 1002 area this coming winter. I know Mary is traveling today but mentioned she could be available for a call this afternoon or tomorrow. As of now, the following times work for Drew and my office. Do any of these work for you and your staff?
> >
> > Wednesday 3pm
> > Thursday after 130pm.
> >
> > Patrick
> >
> > --
> > Patrick Lemons, Ph.D.
> > Chief, Marine Mammals Management
> > U.S. Fish and Wildlife Service
> > 1011 East Tudor Road
> > Anchorage, AK 99503
> > Work: 907-786-3668
> > Cell: 907-717-6787
> > Fax: 907-786-3816
> > e-mail: patrick_lemons@fws.gov

--
Patrick Lemons, Ph.D.
Chief, Marine Mammals Management
U.S. Fish and Wildlife Service
1011 East Tudor Road
Anchorage, AK 99503
Work: 907-786-3668
Cell: 907-717-6787
Fax: 907-786-3816
e-mail: patrick_lemons@fws.gov

From: Banyas, Paul
To: Berendzen, Steve; Joanna Fox; Hollis Twitchell
Subject: Re: DUE COB Thursday 5-10 Fwd: Updated briefing paper on Arctic NWR Infrastructure needs
Date: Thursday, May 10, 2018 12:16:19 PM

All,

Another concern of mine b5-dp [redacted]

Paul

On Wed, May 9, 2018 at 6:24 PM, Berendzen, Steve <steve_berendzen@fws.gov> wrote:

> Greetings,
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>
> Steve Berendzen
> Refuge Manager, Arctic National Wildlife Refuge
> 907-456-0253
>
> ---------- Forwarded message ----------

From: **Damberg, Doug** <doug_damberg@fws.gov>
Date: Wed, May 9, 2018 at 4:50 PM
Subject: DUE COB Thursday 5-10 Fwd: Updated briefing paper on Arctic NWR Infrastructure needs
To: Steve Berendzen <steve_berendzen@fws.gov>, "Fox, Joanna" <joanna_fox@fws.gov>
Cc: Mitch Ellis <mitch_ellis@fws.gov>

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I'm going to need some help answering Greg's questions in relation to our $4M Construction request. Greg Sheehan will be talking to the Deputy Secretary about the proposal and will need concrete examples of how we cooperate with other agencies in the context of sharing/using our facilities. Can you provide your best estimate for:

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d

Doug Damberg
Refuge Supervisor, AK North Zone
U.S. Fish and Wildlife Service
1011 E. Tudor Rd.; Anchorage, AK 99503
Office: (907) 786-3329
Cell: (907) 947-6302

---------- Forwarded message ----------
From: **Greg Siekaniec** <greg_siekaniec@fws.gov>

Date: Wed, May 9, 2018 at 3:51 PM
Subject: Re: Updated briefing paper on Arctic NWR Infrastructure needs
To: "Damberg, Doug" <doug_damberg@fws.gov>
Cc: Mitch Ellis <mitch_ellis@fws.gov>, Socheata Lor <Socheata_Lor@fws.gov>, karen_clark@fws.gov

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> <Alaska Infrastructure Proposals May 2018 Information Memorandum Template.docx>

--

Paul W. Banyas

Maintenance Mechanic

Bear Awareness Instructor, Firearms Instructor,

Armorer, MOCC Instructor, CDSO, COR

Arctic National Wildlife Refuge

101 12th Avenue Room 236

Fairbanks, Alaska 99701

cell (907) 750-8278

Office (907) 456-0240

FAX (907) 456-0428

paul_banyas@fws.gov

"The sting of poor quality lasts long after the thrill of a cheap price has faded"

From:	Fox, Joanna
To:	Berendzen, Steve
Cc:	Hollis Twitchell; Reed, Jennifer; Paul Banyas; Stephen Arthur; Christopher Latty; Soto, Alfredo; Roger Kaye; Wiese, Wilhelm
Subject:	Re: DUE COB Thursday 5-10 Fwd: Updated briefing paper on Arctic NWR Infrastructure needs
Date:	Thursday, May 10, 2018 1:40:55 PM

Folks - don't worry about putting any effort into this yet. I'll use our various calendars to come up with lists of agencies/partners who've used the facilities in the past several years, as well as average numbers of users. We'll distribute that later today for your review - at which time we'll ask you to identify any groups that are missing. I don't want us all to be doing the same thing at the same time - and coming up with nearly the same results. You all have too many other priorities you can focus on right now.

Thank you!

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

Follow us on Facebook!
www.facebook.com/arcticnationalwildliferefuge

"Do what you can, with what you have, where you are." -- Theodore Roosevelt

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Conversation Contents

Dens in Arctic Refuge

Attachments:

/23. Dens in Arctic Refuge/1.1 Dens in Arctic Refuge.pdf
/23. Dens in Arctic Refuge/2.1 Dens in Arctic Refuge.pdf

"Klein, Kimberly" <kimberly_klein@fws.gov>

From:	"Klein, Kimberly" <kimberly_klein@fws.gov>
Sent:	Thu May 10 2018 19:27:45 GMT-0600 (MDT)
To:	Bob Henszey <bob_henszey@fws.gov>, Ted Swem <ted_swem@fws.gov>
Subject:	Dens in Arctic Refuge
Attachments:	Dens in Arctic Refuge.pdf

Here's Ryan Wilson's work on approximating the number of dens in the 1002. I will defer questions to him. Thank for your thoughts and help!

Kimberly Klein
Incidental Take Coordinator
US Fish and Wildlife Service
907-786-3621
<b>Kimberly_Klein@fws.gov

Estimated number of dens in the 1002 area of the Arctic National Wildlife Refuge: a synthesis of published studies.

Ryan R. Wilson, U.S. Fish and Wildlife Service

While there have been no formal analyses to estimate the number of polar bears that form maternal dens in the 1002 area, a number of studies have published estimates of parameters that can be used to develop such an estimate. The parameters required to develop an estimate include:

1. Estimated population size (Bromaghin et al. 2015)
2. Proportion of adult females in the population (Bromaghin et al. 2015)
3. Breeding probability of adult females (Regehr et al. 2010)
4. Proportion of dens that occur on land vs. sea ice (Olson et al. 2017)
5. Proportion of dens that occur on land in the 1002 area (Durner et al. 2010)

Parameters

Estimated population size

Bromaghin et al. (2015) estimated the size of the Southern Beaufort Sea (SB) subpopulation to be 900 (90% CI: 606 – 1212) in 2010 (i.e., the most recent estimate for the subpopulation).

Proportion adult females in the population

Additionally, Bromaghin et al. (2015) provided information on the number of adult females that were captured each year between 2001 – 2010. These data indicated that, on average, the population was composed of 35.1% (SD=3.8) adult females. Using these data to determine the percent of adult females in the population assumes that captured individuals represented a representative sample of the population.

Breeding probability of adult females

Regehr et al. (2010) provides estimates of the breeding probability for adult females in the SB subpopulation. This includes two components; 1) the probability of a female without cubs breeding and producing a litter, and 2) a female that has a litter loses her cubs and rebreeds in a given year. Regehr et al. (2010) reports these estimates of these parameters to be 0.437 (90% CI: 0.325 – 0.558) and 0.104 (90% CI: 0.021 – 0.384), respectively.

Proportion of dens that on land

Based on collar data from bears in the SB from 2007 – 2013, Olson et al. (2017) found that 0.552 (16 of 29) of adult females denned on land versus sea ice.

Proportion of dens that occur in the 1002 area

The United States Geological Survey published a database of all known dens for bears in the SB subpopulation from 1910 – 2010 (Durner et al. 2010). We restricted these data to only dens from 2000 – 2010 that were detected by satellite radio collars. This ensured that den observations were not skewed towards areas with industrial activity or communities, where dens might be

more readily observed. There were a total of 39 dens that occurred on land and of those, 9 occurred in the 1002 area, resulting in an estimate of 0.231 of land-based dens occurring in the 1002 area in any given year. This estimate assumes that the den data obtained from VHF and satellite radio collars are representative of the entire population, and not just those in the area where bears are available to be captured and collared.

Estimation of the number of dens in the 1002 area

I first obtained the estimated number of adult females in the population:

- $N_{AF} = N_{2010} \times p_{AF}$
- $N_{2010} = 900$
- $p_{AF} = 0.351$

I then estimated the number of adult females that bred in a given year:

- $N_{breed} = N_{AF} \times p_{breed0} + N_{AF} \times p_{breed0} \times p_{breed1}$
- $p_{breed0} = 0.437$
- $p_{breed1} = 0.104$

I then estimated the number of denning females that occur on land:

- $N_{land} = N_{breed} \times p_{land}$
- $p_{land} = 0.552$

Finally, I estimated the number of land dens in 1002

- $N_{1002} = N_{land} \times p_{1002}$
- $p_{1002} = 0.231$

Results

$N_{1002} = (900 * .351) * (0.437 + 0.437 * 0.104) * (0.552) * (0.231) = 19.4$

Assumptions

The primary assumption of this analysis is that data derived from collared bears (i.e., den location) and capture efforts (i.e., age/sex distribution) are representative of the entire SB subpopulation and are unbiased. Additional assumptions include that parameter estimates from each study have not changed significantly from when the data were collected to present.

References

Bromaghin, J.F., et al. 2015. Polar bear population dynamics in the southern Beaufort Sea during a period of sea ice decline. Ecological Applications 25:634-651.

Durner, G.M., Fischbach, A.S., Amstrup, S.C., and Douglas, D.C., 2010, Catalogue of polar bear (*Ursus maritimus*) maternal den locations in the Beaufort Sea and neighboring regions, Alaska, 1910–2010: U.S. Geological Survey Data Series 568.

Olson, J.W., et al. 2017. Collar temperature sensor data reveal long-term patterns in southern Beaufort Sea polar bear den distribution on pack ice and land. Marine Ecology Progress Series 564:211-224.

Regehr, E.V., C.M. Hunter, H. Caswell, S.C. Amstrup, and I. Stirling. 2010. Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice. Journal of Animal Ecology 79:117-127.

0000004977

From:	Joanna Fox
To:	Steve Arthur; Chris Latty; Greta Burkart; Hollis Twitchell; Roger Kaye; Alfredo Soto; Jennifer Reed
Cc:	Steve Berendzen
Subject:	Fwd: USGS news item on new 1002 polar bear den analysis
Date:	Friday, May 11, 2018 11:19:18 AM

FYI. Please feel free to share with anyone I missed who may be interested.

Sent from my iPad

Begin forwarded message:

From: Wendy Loya <Wendy_loya@fws.gov>
Date: May 11, 2018 at 9:14:01 AM AKDT
To: Drew Crane <drew_crane@fws.gov>, John Trawicki <john_trawicki@fws.gov>, Steve Berendzen <steve_berendzen@fws.gov>, Joanna Fox <joanna_fox@fws.gov>, Stephanie Brady <stephanie_brady@fws.gov>
Cc: Greg Siekaniec <greg_siekaniec@fws.gov>, Karen Clark <karen_clark@fws.gov>, Paul Leonard <paul_leonard@fws.gov>
Subject: FW: USGS news item on new 1002 polar bear den analysis

Hi 1002 POCs,

Can you forward this new report announcement to interested parties in your divisions?

Thanks,
Wendy

From: Pearce, John <jpearce@usgs.gov>
Sent: Friday, May 11, 2018 9:06 AM
To: Wendy Loya <wendy_loya@fws.gov>; Miriam (Nicole) Hayes <mnhayes@blm.gov>
Subject: USGS news item

Hi Wendy and Nicole,

The following highlight was included in yesterday's USGS weekly report to DOI. I'm passing along for your information. The USGS Open File Report should be publicly available next week and the data release is available now. Both are referenced below.

[NEW] In May or June a new USGS Open File Report entitled "A comparison of photograph-interpreted and IfSAR-derived maps of polar bear den habitat for the 1002 Area of the Arctic National Wildlife Refuge, Alaska" will be available online from the USGS Publications Warehouse. The report describes a qualitative analysis to compare maps of possible polar bear den habitats on the Arctic Coastal Plain of the Refuge. Historically, most polar bears (*Ursus maritimus*) from the Southern Beaufort Sea subpopulation constructed maternity dens on the sea ice.

However, over the last three decades, there has been a shift in the distribution of dens, with most now occurring on land. The qualitative comparison of IfSAR- and photograph-derived maps indicated that differences exist in the ability of the two methods to identify the same maternal denning habitat in the Refuge. Previous work and this report suggests that IfSAR data have limitations that may be surmounted with DTMs whose pixel size is reduced to that of the average footprint of a typical polar bear maternal den. U.S. Fish and Wildlife Service and Bureau of Land Management may use the report and data to inform permitting and planning. This work was requested by the DOI Senior Advisor for Alaskan Affairs and a briefing paper was sent on May 2, 2018. (5/8/2018)

Durner, G.M. and Atwood, T.C. 2018. A comparison of photo-interpreted and IfSAR-derived maps of polar bear den habitat for the 1002 Area of the Arctic National Wildlife Refuge, Alaska: U.S Geological Survey, Open-File Report 2018-5254

Durner, G. M. and Atwood, T. C., 2018, Data Used to Compare Photo-Interpreted and IfSAR-Derived Maps of Polar Bear Den Habitat for the 1002 Area of the Arctic National Wildlife Refuge, Alaska, 2006-2016: U.S. Geological Survey data release, https://doi.org/10.5066/F7DJ5DXT.

John M. Pearce, Ph.D.
Supervisory Wildlife Biologist
Manager, Wetland and Terrestrial Ecosystems Office
U.S.Geological Survey, Alaska Science Center
4210 University Drive
Anchorage, Alaska 99508
Tel. 907.786.7094
Email: jpearce@usgs.gov
http://alaska.usgs.gov/staff/staffbio.php?employeeid=173

Dr. Wendy M. Loya, Coordinator
Office of Science Applications -Arctic Program
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

USGS
science for a changing world

A Comparison of Photograph-Interpreted and IfSAR-Derived Maps of Polar Bear Denning Habitat for the 1002 Area of the Arctic National Wildlife Refuge, Alaska

Open-File Report 2018–1083

U.S. Department of the Interior
U.S. Geological Survey

0000004980

A Comparison of Photograph-Interpreted and IfSAR-Derived Maps of Polar Bear Denning Habitat for the 1002 Area of the Arctic National Wildlife Refuge, Alaska

By George M. Durner and Todd C. Atwood

Open-File Report 2018-1083

U.S. Department of the Interior
U.S. Geological Survey

0000004982

U.S. Department of the Interior
RYAN K. ZINKE, Secretary

U.S. Geological Survey
William H. Werkheiser, Deputy Director
exercising the authority of the Director

U.S. Geological Survey, Reston, Virginia: 2018

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Suggested citation:
Durner, G.M., and Atwood, T.C., 2018, A comparison of photograph-interpreted and IfSAR-derived maps of polar bear denning habitat for the 1002 Area of the Arctic National Wildlife Refuge, Alaska: U.S. Geological Survey Open-File Report 2018–1083, 12 p., https://doi.org/10.3133/ofr20181083.

ISSN 2331-1258 (online)

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0000004984

Conversion Factors

International System of Units to U.S. customary units

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
	Area	
hectare (ha)	2.471	acre
square kilometer (km^2)	247.1	acre
hectare (ha)	0.003861	square mile (mi^2)
square kilometer (km^2)	0.3861	square mile (mi^2)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32.$$

Abbreviations

ANILCA	Alaska National Interests Land Conservation Act
ANWR	Arctic National Wildlife Refuge
DOI	U.S. Department of the Interior
DSM	digital surface model
DTM	digital terrain model
IfSAR	interferometric synthetic aperture radar
NPRA	National Petroleum Reserve–Alaska
RMSE	root mean square error
USGS	U.S. Geological Survey

0000004985

A Comparison of Photograph-Interpreted and IfSAR-Derived Maps of Polar Bear Denning Habitat for the 1002 Area of the Arctic National Wildlife Refuge, Alaska

By George M. Durner and Todd C. Atwood

Abstract

Polar bears (*Ursus maritimus*) in Alaska use the Arctic National Wildlife Refuge (ANWR) for maternal denning. Pregnant bears den in snow banks for more than 3 months in winter during which they give birth to and nurture young. Denning is one of the most vulnerable times in polar bear life history as the family group cannot simply walk away from a disturbance without jeopardizing survival of newly born cubs. The ANWR includes the "1002 Area", a region recently opened for oil and gas exploration by the U.S. Department of the Interior (DOI). As a part of its mission, the DOI "… protects and manages the Nation's natural resources …" and is therefore responsible for conserving polar bears and encouraging development of energy potential. Because future industrial activities could overlap habitats used by denning polar bears, identifying these habitats can inform the decisions of resource managers tasked to develop resources and protect polar bears. To help inform these efforts, we qualitatively compared the distribution of denning habitat identified by two different methods: previously published habitat from manual interpretation of aerial photographs, and habitat derived by computer interrogation of interferometric synthetic aperture radar (IfSAR) digital terrain models (DTM). Because photograph-interpreted methods depicted denning habitat as a line and IfSAR-derived methods depicted habitat as a polygon, we assessed agreement between the two methods with distance measurements. We found that 77.5 percent of IfSAR-derived denning habitat (79.6 km^2; 1.2 percent of the 6,837.0 km^2 1002 Area) was within 600 m of photograph-interpreted habitat (3,026.9 km), including 53.9 percent within 200 m. This distribution differed from that of randomly distributed points, as only 49.4 percent of these occurred within 600 m of photograph-interpreted habitat, including 18.3 percent within 200 m. Both methods appear to identify the major physiographic features that polar bears might select for denning. IfSAR-derived methods identified habitat at greater frequency beyond major landscape features such as coastal bluffs, river banks and lakeshores, were more likely to identify isolated pockets of putative denning habitat, and were easier to implement than deriving habitat from photograph-interpretive efforts. However, previous research suggests that photograph-interpretation methods may identify denning habitat more correctly than computer interrogation of IfSAR DTMs. Future work should quantify the distribution of IfSAR-derived denning habitat relative to actual landscape features and polar bear maternal dens in the 1002 Area, and investigate the feasibility of habitat identification from finer grained DTMs.

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Background and Summary

Historically, most polar bears (*Ursus maritimus*) from the Southern Beaufort Sea subpopulation constructed maternity dens on the sea ice. However, over the last three decades, there has been a landward shift in the distribution of dens, with most now occurring on land (Fischbach and others, 2007; Olson and others, 2017). Based on data collected from radio-tagged adult female bears, maternal denning now occurs at relatively high densities along the central and eastern Arctic coastal plain of Alaska (Pearce and others, 2018). The availability of denning habitat—mediated by landscape features that facilitate the formation of snow drifts—appears to increase in the eastern part of the coastal plain (Durner and others, 2001, 2006).

Durner and others (2006) used manual interpretation of high-resolution aerial photographs to identify 3,621 km of linear denning habitat within a 7,994 km^2 area of the Arctic National Wildlife Refuge (ANWR), which is situated in the eastern side of the Arctic coastal plain. Durner and others (2006) determined that mapped denning habitats in the ANWR were widely distributed and occurred along the coast and inland to the Brooks Range, including part of the coastal plain known as the 1002 Area. Congress created the ANWR under the Alaska National Interests Land Conservation Act (ANILCA) of 1980. Section 1002 of ANILCA designated an area of the coastal plain (that is, the 1002 Area) for potential oil and gas exploration and development.

In December 2017, Federal legislation (that is, Public Law 115-97) was passed that included a provision to open the 1002 Area to oil and gas exploration and eventual extraction. As a result, there is renewed interest in estimating the amount and distribution of polar bear maternal denning habitat in the 1002 Area, as a step toward better understanding environmental and biological characteristics of important polar bear habitats in the ANWR. No evaluation of denning habitat in ANWR has occurred since that described in Durner and others (2006), despite potential improvements in mapping methodologies (for example, Durner and others, 2013). Herein, we describe an analysis done to qualitatively compare maps of maternal denning habitat constructed using manual interpretation of high-resolution color aerial photographs (as described in Durner and others, 2006) and computer interrogation of radar-derived digital terrain models (as described in Durner and others, 2013).

Study Area

The ANWR is the largest and northernmost wildlife refuge in the United States, encompassing 7.9 million hectares. The 1002 Area is a 0.6 million ha region on the coastal plain of the ANWR that lies north of the Brooks Range and south of the Beaufort Sea, with an eastern boundary of the Aichilik River and a western boundary of the Canning River (fig. 1) (Jorgenson and others, 2002). Sixteen land-cover classes have been mapped within the ANWR, with moist sedge-tussock tundra, moist sedge-dryas tundra, wet graminoid tundra, and moist sedge-willow tundra being among the most common land classes in the 1002 Area (Douglas and others, 2002).

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Pearce and others (2018) described how climate conditions of the greater 1002 Area have changed over the last four decades. Jorgenson and others (2015) stated that the mean annual temperature at the Kuparuk weather station, 190 km west of the 1002 Area, increased by 2.5 °C between 1984 and 2009 (Western Regional Climate Center, 2010). Regional marine climate conditions also have changed. For example, warmer air temperatures have been accompanied by rising near-surface sea water temperatures along the coast, which increased by 1.0–1.5 °C during 2007–2011 relative to the 1982–2011 long-term mean (Johannessen and others, 2004; Stroeve and others, 2014). Warmer air and ocean temperatures have altered sea ice extent and phenology, causing the annual number of days that the southern Beaufort Sea was covered by ice to decrease at a rate of -17.5 days per decade from 1979 to 2014 (Stern and Laidre, 2016). Since the late 1990s, the mean duration of the open-water season (that is, period of time when sea ice is largely absent from the biologically productive continental shelf) has increased by 36 days (Atwood and others, 2016).

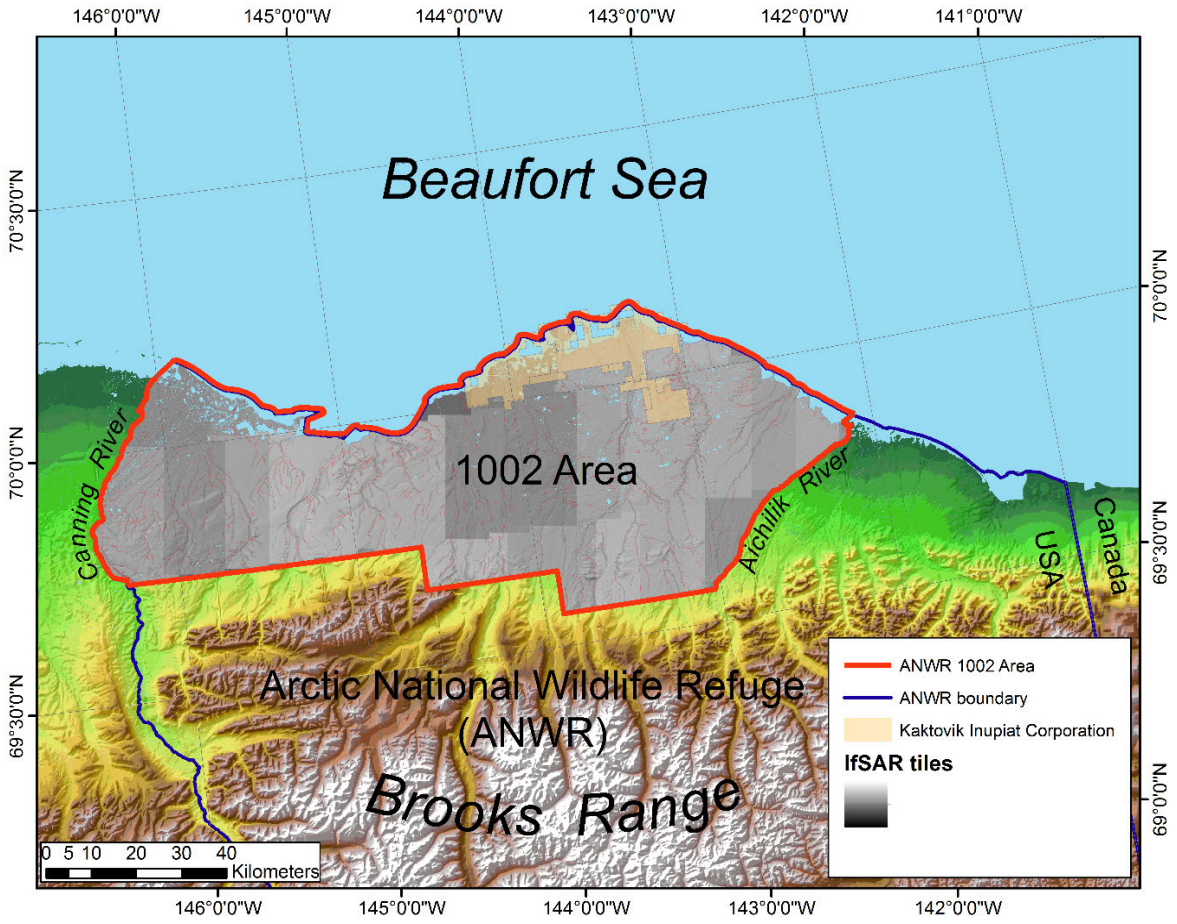


Figure 1. Map showing 1002 Area of the Arctic National Wildlife Refuge, Alaska, including the extent of IfSAR data (that is, IfSAR tiles) used in this report.

Methods

The boundaries of the 1002 Area were obtained as a geographic information system (GIS) shapefile (ESRI, Redlands, California) from the U.S. Fish and Wildlife Service, Region 7, Realty and Natural Resources GIS data page (https://www.fws.gov/alaska/nwr/realty/data.htm; accessed December 21, 2017). We determined that the northern boundary of the original 1002 Area GIS data excluded parts of barrier islands when overlaid on interferometric synthetic aperture radar (IfSAR) digital terrain models. To ensure that all lands within the east, west, and southern boundaries of the 1002 Area were included in our analysis, we extended the northern boundary 500 m seaward. This modified 1002 Area became the study area used in subsequent analyses and includes all coastal barrier islands, nearshore marine waters and the area of the Kaktovik Inupiat Corporation (fig. 1).

IfSAR-Derived Maternal Denning Habitat

A digital terrain model (DTM) derived from IfSAR elevation data was used to construct a map of denning habitat for comparison to the photograph-interpreted map described in Durner and others (2006). IfSAR data for the 1002 Area of the ANWR (fig. 1) were collected by Intermap Technologies during July–August 2016 with the Intermap STAR-3i® airborne IfSAR system (Intermap, 2016) and processed into a digital surface model (DSM). The DSM had a horizontal cell dimension of 5 × 5 m (1.25 m root mean square error, or RMSE) and a vertical cell resolution of 0.01 m (1.0 m RMSE; Nolan and Prokein, 2003; Intermap, 2016). The DSM was composed of overlapping 15 × 15 minute (latitude × longitude) tiles in UTM projection. Intermap Technologies converted the DSM into a DTM by removing buildings and vegetation so that the final elevation data represented a closer approximation to the true surface of Earth. DTM projection information is provided in table 1.

Table 1. Projection data for the IfSAR digital terrain models used for estimating polar bear maternal denning habitat in the Arctic National Wildlife Refuge 1002 Area.

Projection	Albers
Datum	NAD83
Units	meters
1st standard parallel	55 0 0.00 (degrees minutes seconds)
2nd standard parallel	65 0 0.00 (degrees minutes seconds)
central meridian	-154 0 0.00 (degrees minutes seconds)
false easting (meters)	0.0
false northing (meters)	0.0

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The procedures of Durner and others (2013) were followed and GIS tools were used to identify individual pixels from the DTM that had an elevation difference of greater than or equal to 1.0 m between the focal pixel and all surrounding pixels within a 3 × 3 neighborhood. Pixels meeting this criterion were deemed sufficient to facilitate the accumulation of drifting snow to allow polar bears to den (that is, polar bear maternal denning habitat). Identified pixels were converted into an ESRI polygon coverage. No field measurements were available with which to assess the ability of IfSAR to identify polar bear maternal denning habitat correctly in the 1002 Area. However, Durner and others (2013) determined that similar methods used on IfSAR data in the National Petroleum Reserve–Alaska correctly identified 82 percent of denning habitat.

Photograph-Interpreted Maternal Denning Habitat

An ESRI line coverage of features depicting putative linear maternal denning habitat was created from photograph-interpretation methods for the ANWR coastal plain (Durner and others, 2006; obtained from https://alaska.usgs.gov/science/biology/polar_bears/products.html, accessed January 2018). Denning habitat was derived by manual interpretation of high-resolution aerial photographs (scale: 1 centimeter (cm) = 178.6 m), which were subsequently digitized (Durner and others, 2001). The final denning habitat map was ground-truthed with 127 survey transects that radiated west, south, and east from the general vicinity of Barter Island (see Durner and others, 2006, fig. 1). Additionally, 38 polar bear dens located in years prior to the mapping effort were used as a qualitative check of mapped habitat. The photograph-interpreted denning habitat map was in agreement with the distribution of 84 percent (32) of the 38 known dens and 91.5 percent of denning habitat measured in the field (Durner and others, 2006).

Comparing Photograph-Interpreted Denning Habitat to IfSAR-Derived Denning Habitat

Durner and others (2001) determined that the distance between mapped denning habitat and the actual features on the ground averaged 32.0 m (standard deviation: ±29.2 m). Ground-truthing of IfSAR-derived denning habitat on the 1002 Area has not been done; hence, a similar estimate of spatial error was not possible. Therefore, we limited the horizontal error for IfSAR pixels to 1.25 m RMSE (Intermap, 2016). Because photograph-interpreted denning habitat was composed of lines, it was not possible to estimate the actual area of the habitat to directly compare to IfSAR-derived habitat (composed of polygons). As a result, we compared proximity of features between the two methods instead of area of overlap. We assumed that IfSAR habitat less than or equal to 62.45 m from photograph-interpreted habitat implied agreement between the two methods. This assumption accommodated most human error in drafting the original lines that delineated denning habitat, potential errors in 1:63,360 topographical maps used (Durner and others, 2006), and the estimated horizontal error of IfSAR pixels (Intermap, 2016). GIS distance tools were used to measure the proximity of features derived from the two methods. Differences were qualitatively compared as a histogram with frequencies by 200 m distance bins.

The resulting large abundance of IfSAR denning habitat polygons (see section, “Results”) suggested that the distribution of IfSAR-derived habitat could reflect a uniform distribution across the 1002 Area. To compare the actual distribution of IfSAR habitat to a uniform distribution, we used randomly distributed points as a proxy of denning habitat across the landscape. Then the proximity between random points and photograph-interpreted habitat was measured and this distribution was qualitatively compared as a histogram with frequencies by 200 m distance bins overlaid on IfSAR distance bins.

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Results

The original study area as defined by U.S. Fish and Wildlife Service, Region 7, was 6,741.1 km^2 for the 1002 Area and 0.55 km^2 for the village of Kaktovik. After applying a 500 m seaward extension to the northern border, the entire study area, including marine waters within the 500 m seaward extension, was 6,837.0 km^2.

IfSAR-Derived Maternal Denning Habitat

A total of 152,503 unique polygons comprising 79.6 km^2 of polar bear maternal denning habitat were derived from the interrogation of the IfSAR DTM. This represented 1.2 percent of the 6,837.0 km^2 1002 Area.

Photograph-Interpreted Maternal Denning Habitat

The total length of photograph-interpreted denning habitat within the 1002 Area was 3,026.9 km. Durner and others (2006) found the distribution of photograph-interpreted denning habitat was uniform throughout the coastal plain of the ANWR.

Comparison of Photograph-Interpreted Denning Habitat to IfSAR-Derived Denning Habitat

The distribution of IfSAR-derived denning habitat polygons generally occurred in close proximity to photograph-interpreted linear denning habitat (fig. 2). Distance measures between IfSAR-derived and photograph-interpreted denning habitat showed that 82,201 IfSAR polygons (53.9 percent) occurred within 200 m of photograph-interpreted linear denning habitat, including 17,654 IfSAR polygons (11.6 percent) within the assumed 62.45 m mapping error. Area within 600 m of photograph-interpreted habitat included 118,260 (77.5 percent) IfSAR polygons (fig. 2). This distribution differs from that of 152,503 locations distributed randomly within the 1002 Area. For random locations, 28,156 (18.3 percent) were within 200 m of photograph-interpreted habitat and 75,296 (49.4 percent) were within 600 m (fig. 2). Hence, IfSAR-derived habitat was spatially distributed closer to photograph-interpreted habitat than could be expected by chance. Whereas photograph-interpreted habitat generally followed linear landscape features that could be recognized by the cartographer drafting the habitat maps, IfSAR-derived habitat also included discontinuous, finer-scale landscape features, demonstrating the ability of computer processing to capture isolated pockets of suitable habitat that were not recognized in manual interpretation of aerial photographs (fig. 3).

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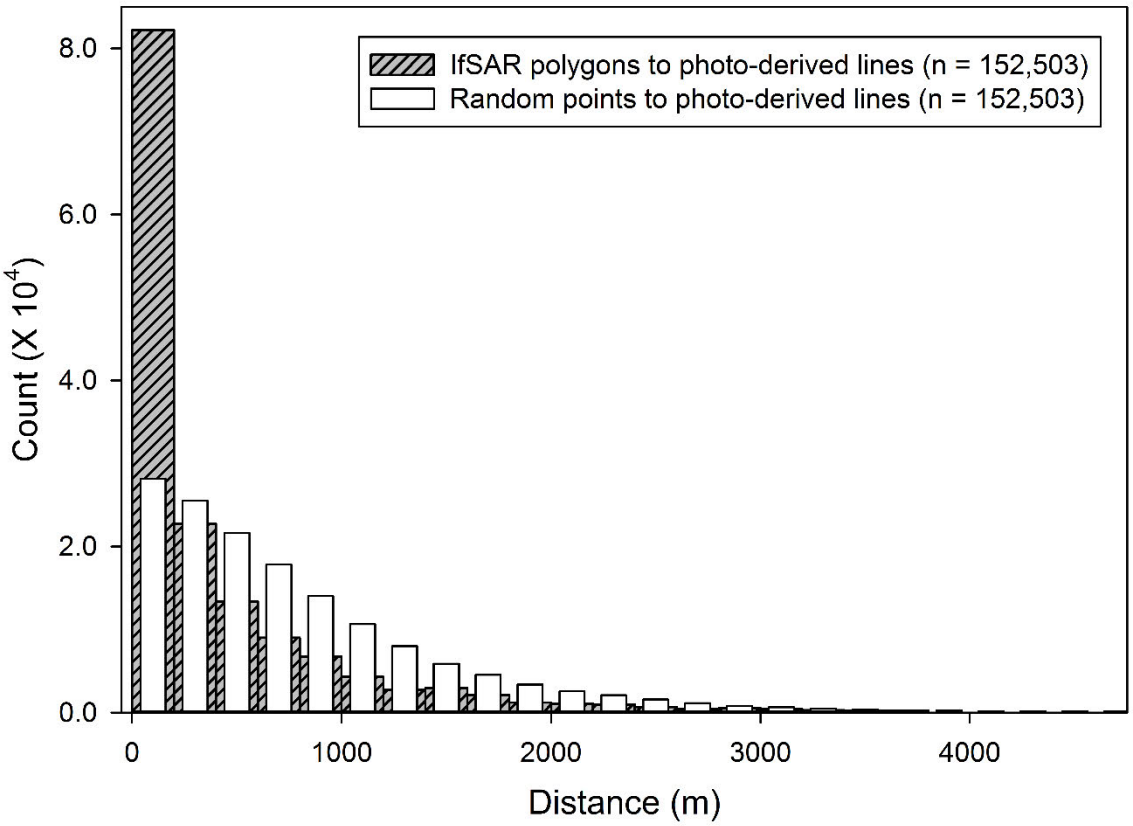


Figure 2. Distance between IfSAR-derived maternal denning habitat polygons (n = 152,503) and random locations (n = 152,503) within the 1002 Area of the Arctic National Wildlife Refuge, to photograph-interpreted maternal denning habitat lines (n = 4,458). Bins are centered within 200 m intervals. The comparison suggests a high level of spatial agreement between polar bear denning habitats derived with IfSAR (polygons) and habitat derived from photograph-interpretation (lines), and that IfSAR-derived habitat is not uniformly distributed. The x-axis has been truncated to 4,750 meters (m).

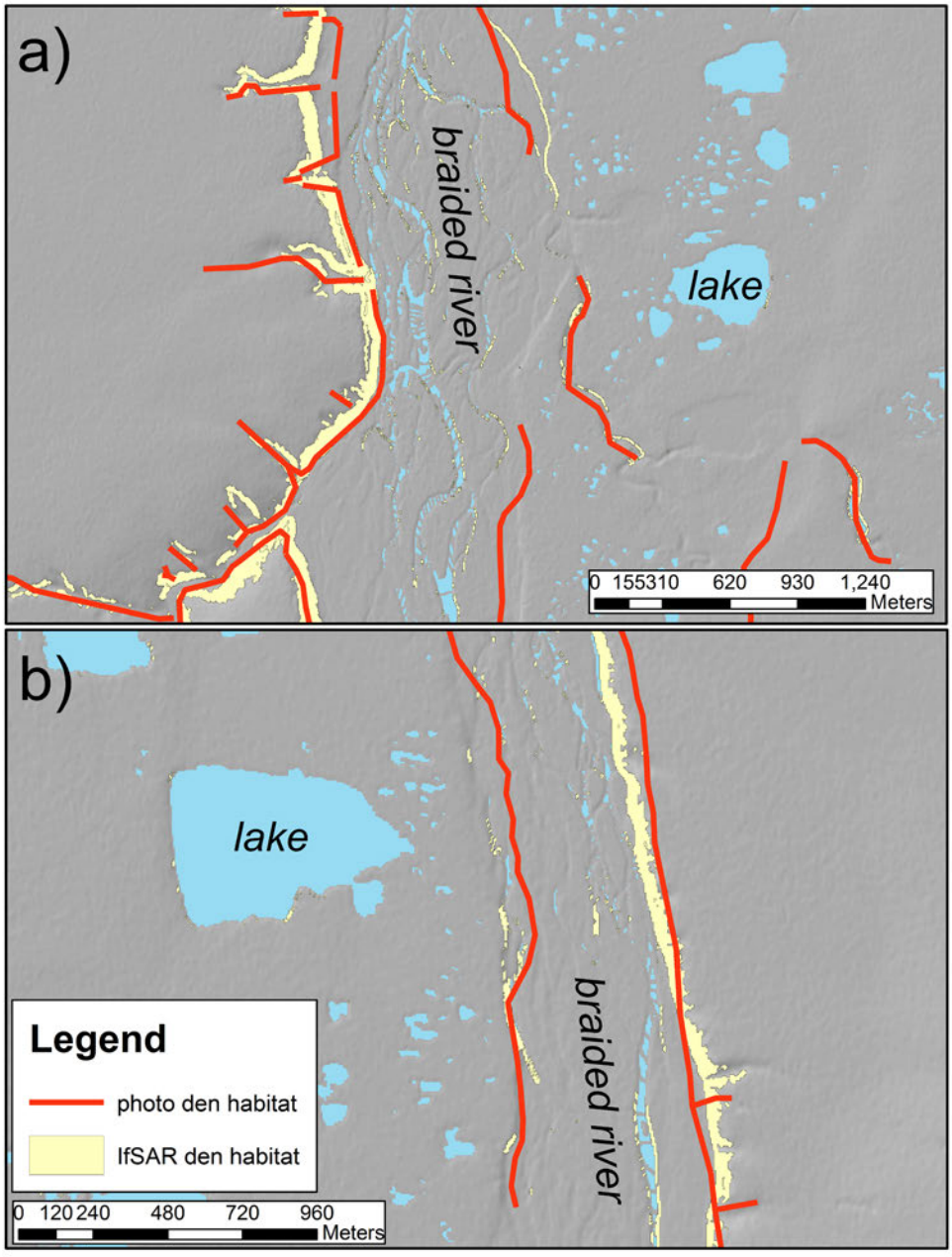


Figure 3. Comparisons of photograph-interpreted and IfSAR-derived polar bear maternal denning habitat in the 1002 Area of the Arctic National Wildlife Refuge, Alaska. Photograph-interpreted habitat followed large and easily identified terrain features identified on aerial photographs. IfSAR-derived habitat identified landscape nuances including isolated pockets of suitable habitat. (Note delineated habitat on lakeshores and in braided rivers).

Discussion

The qualitative comparison of IfSAR-derived and photograph-interpreted maps indicated that differences exist in the ability of the two methods to identify the same maternal denning habitat in the ANWR. Terrain features suitable for denning habitat in the ANWR mostly include large segments of the coast and river- and streambanks (Durner and others, 2006) and denning habitat identified by both mapping methods consisted mostly of those features.

It is important to reiterate that the two methods were not easily comparable due to the previously mentioned differences in the initial formats of the respective datasets. IfSAR-derived denning habitat was formatted as polygons, which allowed the areal estimation of denning habitat. Photograph-interpreted denning habitat was formatted as lines, allowing the linear estimation of denning habitat. Therefore, only an indirect comparison (proximity) between these two methods is possible. Although we attempted to account for the potential spatial error when assessing agreement between the two methods, we note that, unlike photograph-interpreted habitat, we lacked a similar field error estimate for IfSAR-derived habitat. Therefore, we can reasonably expect that the spatial error we used (that is, 62.45 m) would have been larger if we had verified IfSAR denning habitat in the field. This could have suggested greater agreement between the two methods, by virtue of a larger spatial error. Hence, the results presented in this report are conservative.

Despite what appears to be a large discrepancy in the distribution of photograph-interpreted lines and IfSAR-derived polygons, non-overlapping features from each method often were in close proximity. For example, photograph-interpreted habitat often bordered the large banks on both sides of braided rivers and small pockets of IfSAR-derived habitat within the river corridor (fig. 3). More than 77 percent of IfSAR-derived habitat was less than 600 m from photograph-interpreted maternal denning habitat and our comparison to distances from randomly derived locations suggests the observed distribution was a function of habitat and not chance. Both photograph- and IfSAR-derived habitats capture the major physiographic features that polar bears may select for denning.

Durner and others (2013) determined that an IfSAR-derived DTM used to map maternal denning habitat for the National Petroleum Reserve−Alaska (NPRA) had a greater omission error rate (18 percent) than photograph-interpreted methods (8.5 percent) used for the ANWR (Durner and others, 2006). Durner and others (2013) suggested two reasons why a greater omission error could be expected from analysis of IfSAR data. First and probably most important, the 5 × 5 m pixel size of IfSAR imagery may preclude its ability to resolve very-fine scale landscape features suitable as maternal denning habitat. Of polar bear maternal den chambers (that is, the cavity where the adult and her cubs will spend the winter) measured in the field, the maximum width was 190 cm and there was an average of 72 cm of snow between the interior of the den and the environment (Durner and others, 2003). Assuming that dens have a circular area (radius 95 + 72 cm), the footprint of a polar bear den could be 8.76 m^2. This is a magnitude smaller than the area of an IfSAR pixel (25 m^2). Hence, landscape features suitable for accumulating snow sufficient for denning are sometimes not detected by IfSAR sensors or identified by subsequent processing of IfSAR data. Second, vertical accuracy could influence the outcome. Although the vertical resolution of the native DSM was 0.01 m, independent estimation of the vertical accuracy was greater than or equal to 0.46 m RMSE (Mercuri and others, 2006). This means that differences as small as 1 cm between IfSAR data and the true landscape could make the difference

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between a cell classified as denning habitat or not. Altering the minimum threshold elevation difference (that is, less than 1.0 m) between neighboring IfSAR pixels will reduce the omission error rate for identifying denning habitat (Durner and others, 2013). However, by reducing the threshold for IfSAR pixel capture the error rate for false positive denning habitat will also increase, causing the method to identify more polygons of denning habitat than actually occurs on the landscape. Durner and others (2013) estimated a 25 percent error rate for false positives when the selection threshold was set at 1.0 m, compared to an approximately 10 percent error rate for false positives when the selection threshold was 1.3 m.

Both IfSAR-derived and photograph-interpretation methods for identifying potential polar bear maternal denning habitat similarly identify major landscape features. Manual photograph-interpretive methods appeared to correctly identify 95.5 percent of denning habitat (Durner and others, 2006). Because field verification is lacking within the 1002 Area for IfSAR-derived habitat we were not able to make a similar assessment, but correct identification is likely lower (that is, near 82 percent; Durner and others, 2013). Photograph-interpretive cartography methods are labor-intensive, so reassessing habitat is costly and does not lend itself to adjusting thresholds. For example, once photograph-interpreted denning habitat is identified it is not known whether the denning habitat is 1 or 5 m in height. In contrast, IfSAR elevation data provide a relatively cost-effective (after initial collection), flexible and repeatable means for identifying most polar bear maternal denning habitat within a region. Previous work (Durner and others, 2013) and this report suggests that IfSAR data have limitations that may be surmounted with DTMs whose pixel size is reduced to that of the average footprint of a typical polar bear maternal den.

Summary

We qualitatively compared two methods for identifying polar bear maternal denning habitat in the ANWR 1002 Area. We determined that manual photograph-interpretive methods and computer processing of IfSAR DTMs produce similar estimates on the distribution of denning habitat. Differences exists between the two methods in their ease of execution, their output, and the accuracy of output relative to actual landscape features. Future investigations should ground-truth IfSAR-derived denning habitat to quantify precision and omission of actual polar bear maternal denning habitat on the ANWR 1002 Area.

Acknowledgments

We thank S. Breck, D. Grillo, and H. Johnson, whose constructive review of this report led to its improvement. Data or data sources used in this report are available from the USGS (Durner and Atwood, 2018).

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Publishing support provided by the U.S. Geological Survey
Science Publishing Network, Tacoma Publishing Service Center

For more information concerning the research in this report, contact the
Director, Alaska Science Center
U.S. Geological Survey
4230 University Drive
Anchorage, Alaska 99508
https://alaska.usgs.gov

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ISSN 2331-1258 (online)
https://doi.org/10.3133/ofr20181083

From: Twitchell, Hollis
To: Fox, Joanna; Brandon Bosch
Subject: Re: Best dates for internal Alternatives workshop week of June 18th?
Date: Monday, May 14, 2018 12:37:48 PM

I'm scheduled to be flying with Brandon on his orientation to the refuge on those dates in June, 18-20th. However, I'm also scheduled to fly with him the week before. If need be, I could come back earlier than what we had planned to attend these meeting dates. I was planning to fly with Brandon through the weekend, weather permitting. For me, it would be preferable to meet during the June 19th through the 21st. Most likely Brandon and I will be good and tired of looking at the talking to each other by that time, so coming back a bit earlier may not be a bad thing. Just don't want to cut Brandon short on his schedule.

On Mon, May 14, 2018 at 9:38 AM, Fox, Joanna <joanna_fox@fws.gov> wrote:

> The feedback we've received so far has us leaning toward Monday, Tuesday and Wednesday, June 18-20 as days that would work best for this workshop. Will any of those dates work for you, and if not, what ones would work better?
>
> _____
> Joanna L. Fox
> Deputy Refuge Manager
> Arctic National Wildlife Refuge
> 101 12th Avenue, Room 236
> Fairbanks, AK 99701
> (907) 456-0549
>
> Follow us on Facebook!
> www.facebook.com/arcticnationalwildliferefuge
>
> *"Do what you can, with what you have, where you are." -- Theodore Roosevelt*
>
> ---------- Forwarded message ----------
> From: **Joanna Fox** <joanna_fox@fws.gov>
> Date: Fri, May 11, 2018 at 9:15 AM
> Subject: Fwd: Best dates for internal Alternatives workshop week of June 18th?
> To: Roger Kaye <roger_kaye@fws.gov>, Hollis Twitchell <hollis_twitchell@fws.gov>, Jennifer Reed <jennifer_reed@fws.gov>, Steve Arthur <stephen_arthur@fws.gov>, Greta Burkart <greta_burkart@fws.gov>, Chris Latty <christopher_latty@fws.gov>
> Cc: Steve Berendzen <steve_berendzen@fws.gov>
>
> Good morning,
>
> Would each of you please look at your calendars for the week of June 18 and reply back to me with the dates that week that will work for you to attend an internal alternatives workshop for the leasing EIS here in Fairbanks? We're looking for 2 consecutive days, though both may not be needed ultimately.
>
> Thank you,
> Joanna
>
> Sent from my iPad

Begin forwarded message:

From: Wendy Loya <Wendy_loya@fws.gov>
Date: May 11, 2018 at 9:08:17 AM AKDT
To: Steve Berendzen <steve_berendzen@fws.gov>, Joanna Fox <joanna_fox@fws.gov>
Subject: Best dates for internal Alternatives workshop week of June 18th?

Hi Steve and Joanna,

Wanted to check and see what you all thought about the best 2 days for an internal workshop to prepare for the BLM alternative workshop on approx. July 9th? I am not sure of the agenda; will work on a draft next week, which will help determine if it is 1 or 2 days….thinking maybe most of one day with all staff and maybe a subset that will attend the BLM workshop on the 2nd day to focus on what we want to bring to the table. Paul Leonard will help us with the spatial aspects of the discussion, analyses and presentation.

Thanks!

Wendy

Dr. Wendy M. Loya, Coordinator

Office of Science Applications -Arctic Program

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

--
Hollis Twitchell
Assistant Manager
Arctic Refuge

From: Wendy Loya
To: John Trawicki; Drew Crane; Eric Taylor
Subject: FW: Draft Seismic Exploration EA - Affected Environment
Date: Thursday, May 17, 2018 12:04:51 PM

Hi Leasing POCs,

Keeping you in the loop on the Seismic EA. I will work with Steve and Joanna on consistent messaging and communication as we work these two parallel processes this summer.

Yikes! Lots happening,

Wendy

From: Joanna Fox <joanna_fox@fws.gov>
Sent: Wednesday, May 16, 2018 3:02 PM
To: Stephen Arthur <stephen_arthur@fws.gov>; Christopher Latty <christopher_latty@fws.gov>; Burkart, Greta <greta_burkart@fws.gov>; Hollis Twitchell <hollis_twitchell@fws.gov>; Jennifer Reed <jennifer_reed@fws.gov>; Roger Kaye <Roger_Kaye@fws.gov>; Joshua Rose <joshua_rose@fws.gov>; Swem, Ted <ted_swem@fws.gov>; Erin Carver <erin_carver@fws.gov>; Patrick O'Dell <patrick_odell@fws.gov>; Edward Decleva <edward_decleva@fws.gov>; Brown, Randy <randy_j_brown@fws.gov>
Cc: Steve Berendzen <steve_berendzen@fws.gov>; Sarah Conn <sarah_conn@fws.gov>; Lynnda Kahn <lynnda_kahn@fws.gov>; Wendy Loya <wendy_loya@fws.gov>; stephanie_brady <stephanie_brady@fws.gov>
Subject: Draft Seismic Exploration EA - Affected Environment

Good morning,

If you are receiving this message, you have either been identified as a lead member of the FWS Seismic Exploration Interdisciplinary Team, or as someone who has expertise that can assist in the development and review of the Environmental Assessment (EA) to analyze the impacts of seismic exploration in the Coastal Plain of the Arctic Refuge.

Specifically, BLM is tasking the FWS team with the responsibility for writing Chapter 3 of the EA (Existing Condition, or what we usually refer to as the Affected Environment). The current proposed timeline has us drafting this Chapter from May 16 (today) through May 25. We anticipate the timeline is going to get bumped back, but not significantly. Therefore, we believe it is imperative that we start our work on this project immediately.

To expedite and make this task as simple as possible, we propose we use the Draft Affected Environment chapter that was prepared last fall when we were tasked with changing the regulations for geological exploration of the 1002 area as a template. We are asking each of you to edit that document as you deem appropriate for this new proposed activity. Please edit and add comments to the Google Doc where you have subject matter expertise. We will consider this our working draft. Also - if you feel there are Affected Environment categories that are missing, please add them where you think appropriate (for example: it may be worth adding special designations like Wild & Scenic Rivers and Marine Protected Areas).

As you work, please keep in mind that under the new Department NEPA direction, complex EAs will be required to be less than 50 pages in length (appendices are not included in the total page numbers). For this task, you should include the level of detail you deem appropriate for the resource you have expertise about, recognizing that you will be tasked with providing a summary of that resource for the body of the EA.

Thanks much for your assistance with this project! If you have any questions or need additional clarification, please let me know.

Joanna

_____

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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"Do what you can, with what you have, where you are." -- Theodore Roosevelt

907 456-0512 w
907 378-5732 c

From: Latty, Christopher
To: Churchwell, Roy
Subject: Fwd: Draft Seismic Exploration EA - Affected Environment
Date: Thursday, May 17, 2018 1:54:22 AM

Hi Roy,

Got this this afternoon. I'll be drafting something tomorrow, then sending it your way to review before I head down to California tomorrow evening.

Cheers
Chris

---------- Forwarded message ----------
From: **Joanna Fox** <joanna_fox@fws.gov>
Date: Wed, May 16, 2018 at 3:01 PM
Subject: Draft Seismic Exploration EA - Affected Environment
To: Stephen Arthur <stephen_arthur@fws.gov>, Christopher Latty <christopher_latty@fws.gov>, "Burkart, Greta" <greta_burkart@fws.gov>, Hollis Twitchell <hollis_twitchell@fws.gov>, Jennifer Reed <jennifer_reed@fws.gov>, Roger Kaye <Roger_Kaye@fws.gov>, Joshua Rose <joshua_rose@fws.gov>, "Swem, Ted" <ted_swem@fws.gov>, Erin Carver <erin_carver@fws.gov>, Patrick O'Dell <patrick_odell@fws.gov>, Edward Decleva <edward_decleva@fws.gov>, "Brown, Randy" <randy_j_brown@fws.gov>
Cc: Steve Berendzen <steve_berendzen@fws.gov>, Sarah Conn <sarah_conn@fws.gov>, Lynnda Kahn <lynnda_kahn@fws.gov>, Wendy Loya <wendy_loya@fws.gov>, stephanie_brady <stephanie_brady@fws.gov>

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Thanks much for your assistance with this project! If you have any questions or need additional clarification, please let me know.

Joanna

_____

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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--

Christopher Latty
US Fish and Wildlife Service
Arctic NWR
101 12th Avenue
Room 236
Fairbanks, AK 99701
cell 907-347-4300

From:	Latty, Christopher
To:	Churchwell, Roy
Subject:	Fwd: Species of Conservation Conern
Date:	Thursday, May 17, 2018 2:00:05 AM
Attachments:	Species of special status_CL_Draft.docx

Hi Roy,

BLM asked Steve Berendzen to provide a list of list similar to the BLM Special Status species list.

I've attached my thoughts so far. I wanted to get your thoughts again before passing it around to the larger group. Please let me know your thoughts on the use of the lists outlined in the document and which of the various levels of conservation concern you think should be included from the various Conservation Plan lists.

I'm headed out of town tomorrow till next Wednesday, so if there is any way you can look this over in the am that would be great.

Thanks!

Cheers
Chris

--
Christopher Latty
US Fish and Wildlife Service
Arctic NWR
101 12th Avenue
Room 236
Fairbanks, AK 99701
cell 907-347-4300

--
Christopher Latty
US Fish and Wildlife Service
Arctic NWR
101 12th Avenue
Room 236
Fairbanks, AK 99701
cell 907-347-4300

BLM-Alaska Special Status Plant and Animal Species List – 2010

As per BLM 6840 Manual direction (revised in December 2008), the Alaska State Director must designate and manage sensitive species in part to reduce the likelihood and need for new listings under the Endangered Species Act (ESA). The manual dictates that the list must include species designated as candidate and proposed under the ESA, as well as species that have been de-listed from the ESA in the past five years. Species designated as BLM sensitive must be native species that occur on BLM lands, and for which BLM has significant management capability to affect their conservation status. In addition, one of the following two criteria must also apply: (1) There is information that a species is known or predicted to undergo a downward trend such that viability of the species or a distinct population segment of the species is at risk across all or a significant portion of its range, or (2) The species depends on ecological refugia, specialized habitats or unique habitats, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk.

BLM-Alaska Sensitive Plant List

Common Name	Scientific Name
	Antennaria densifolia
Northern Arnica	*Arnica lonchophylla*
	Artemisia globularia ssp. lutea
Siberian Wormwood	*Artemisia laciniata*
Arctic Sage	*Artemisia senjavinensis*
Pygmy Aster	*Aster pygmaeus (Eurybia pygmaea)*
Moonwort	*Botrychium ascendens*
Circumpolar Sedge	*Carex adelostoma*
Arctic Springbeauty	*Claytonia arctica*
Ogilvie Mts Spring Beauty	*Claytonia ogilviensis*
Shacklettes' Catseye	*Cryptantha shackletteana*
Alaska Rock-jasmine	*Douglasia alaskana*
Mackenzie River Douglasia	*Douglasia arctica*
Arctic Dwarf Primrose	*Douglasia beringensis*
Alpine Whitlow-grass	*Draba micropetala*
Murray's Whitlow-grass	*Draba murrayi*
	Draba ogilviensis
Adam's Whitlow-grass	*Draba pauciflora*
Muir's Fleabane	*Erigeron muirii*
	Erigeron yukonensis
Yukon Wild-buckwheat	*Eriogonum flavum var. aquilinum*
A wallflower	*Erysimum asperum var. angustatum*
Sheared Gentian	*Gentianopsis detonsa ssp. detonsa*
Oriental Junegrass	*Koeleria asiatica*
Calder's Bladderpod	*Lesquerella calderi*
Drummond's Bluebell	*Mertensia drummondii*
Bostock's Miner's-lettuce	*Montia bostockii*
Barneby's Locoweed	*Oxytropis arctica var. barnebyana*
	Oxytropis huddelsonii
Kobuk Locoweed	*Oxytropis kobukensis*
Pale Poppy	*Papaver alboroseum*
	Papaver gorodkovii
Walpole Poppy	*Papaver walpolei*
	Parrya nauruaq
	Pedicularis hirsuta
Macbride Phacelia	*Phacelia mollis*
Sabine-grass	*Pleuropogon sabinei*
	Poa hartzii ssp. alaskana
	Poa porsildii
Circumpolar Cinquefoil	*Potentilla stipularis*
Chukchi Primrose	*Primula tschuktschorum*
	Puccinellia wrightii
	Ranunculus camissonis
	Ranunculus glacialis var. 1
Turner's Butter-cup	*Ranunculus turneri*
	Rumex graminifolius
Cape Krause Sorrel	*Rumex krausei*
	Smelowskia johnsonii
	Smelowskia pyriformis
Siberian False-oats	*Trisetum sibiricum ssp. litorale*

BLM-Alaska Sensitive Animal List

Common Name	Scientific Name
Golden Eagle	*Aquila chrysaetos*
Short-eared Owl	*Asio flammeus*
Kittlitz's Murrelet	*Brachyramphus brevirostris*
Marbled Murrelet	*Brachyramphus marmoratus*
Dusky Canada Goose	*Branta canadensis occidentalis*
Red Knot	*Calidris canutus*
Bering Sea Rock Sandpiper	*Calidris ptilocnemis tschuktschor*
Emperor Goose	*Chen canagica*
Olive-sided Flycatcher	*Contopus cooperi*
Trumpeter Swan	*Cygnus buccinator*
Blackpoll Warbler	*Dendroica striata*
Rusty Blackbird	*Euphagus carolinus*
Yellow-billed Loon	*Gavia adamsii*
Bristle-thighed Curlew	*Numenius tahitiensis*
McKay's Bunting	*Plectrophenax hyperboreus*
Alaskan Hare	*Lepus othus*
Kenai Marten	*Mustela americana kenaiensis*
Alaskan Tiny Shrew	*Sorex yukonicus*
Osgood's Arctic Ground Squirrel	*Spermophilus parryii osgoodi*
Alaskan Brook Lamprey	*Lampetra alaskensis*
Arctic Char (Kigluaik Mtns)	*Salvelinus alpinus*
A mayfly	*Acentrella feropagus*
Alaska Sallfly	*Alaskaperla ovibovis*
Alaska Endemic Mayfly	*Rhithrogena ingalik*

ESA Listed and Candidate Species

Including species under review or previously reviewed
(All species are considered BLM Sensitive)

ESA Listed Species
Steller's eider (*Polysticta stelleri*) (threatened)
Spectacled eider (*Somateria fischeri*) (threatened)
Short-tailed albatross (*Phoebastria albatrus*) (endangered)
Northern sea otter (*Enhydra lutris kenyoni*) (threatened) SW DPS
Polar bear (*Ursus maritimus*) (threatened)
Aleutian shield fern (*Polystichum aleuticum*) (endangered)
Eskimo curlew (*Numenius borealis*) (endangered)
Wood bison (*Bison bison athabascae*) (threatened) (10(j))
Candidate Species
Pacific walrus (*Odobenus rosmarus divergens*)
Listed Species Only in Canada
Queen Charlotte goshawk *(Accipiter gentilis laingi)*
Previous Candidate Species
Kittlitz's murrelet *(Brachyramphus brevirostris)*
Yellow-billed loon (*Gavia adamsii*)
Other Species Under Review
Alexander Archipelago wolf *(Canis lupus ligoni)*

We circulated the question of what lists are available for species of conservation priority for the Refuge Arctic Coastal Plain among the bird group and here is what we came up with.

There are several conservation priority lists for birds that would be applicable that have been developed by FWS or that are part of Conservation Plans that FWS was a partner on. There is also the Region 7 Priority Species list, but it's unclear if that is appropriate for this purpose.

The Birds of Conservation Concern (BCC) is a 2008 document by FWS. The purpose of that document was to "accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent our highest conservation priorities". Some issues with the plan are 1) it's now somewhat outdated, and 2) it excludes waterfowl covered by the North American Waterfowl Management Plan.

The Birds of Management Concern (BMC) is a 2011 document by FWS. The purpose of that document was to identify a "list of species, subspecies, populations or geographic segments of populations that warrant management or conservation attention, as identified by the U.S. Fish and Wildlife Service". To be of management concern they deemed a bird "must be a high priority gamebird, on the BCC, a federal threatened or endangered species, or overly abundant leading to management conflicts". Therefore, while this list includes waterfowl, it lists the majority of waterfowl species and populations that are actively managed by the Service.

Within the BMC is a Focal Species list. The purpose of that list was to identify "a subset of the Birds of Management Concern... the program believes need additional investment of resources to address pertinent conservation or management issues". While this list does a better job of narrowing the scope, the purpose was more to direct resources.

There are also various bird conservation plans (e.g., Partners in Flight North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan). Because the BCC used conservation assessment scores from these Plans, and many of these Plans have been updated since the BCC, we suggest the use of the BCC unless the underlying Conservation Plan is more up-to-date (which would be the case for the Landbird and Shorebird Plans). For waterfowl, I would suggest using the either the Focal Species list or the FWS Region 7 Priority Species list.

Shorebirds: U.S. Shorebirds of Conservation Concern. 2016. U.S. Shorebird Conservation Plan Partnership

Landbirds: Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. 2016. Partners in Flight Science Committee

Waterbirds: Birds of Conservation Concern. 2008. U.S. Fish and Wildlife Service

Waterfowl: Focal Species list *from* Birds of Management Concern. 2011. U.S. Fish and Wildlife Service

Fairly common species (as listed in Summary of Wildlife-Related Research on the Coastal Plain of the Arctic National Wildlife Refuge, Alaska, 2002–17) that are on these lists:

Shorebirds:

- Species of Greatest Conservation Concern
  - *None*
- Species of High Concern
  - American Golden-Plover
  - Dunlin (*arcticola)*
  - Buff-breasted Sandpiper
  - Pectoral Sandpiper
  - Semipalmated Sandpiper

Landbirds:

- Red List
  - *None*
- Yellow List
  - Snowy owl

Waterbirds:

- BCC List for BCR 3
  - Red-throated loon
  - Yellow-billed loon
  - Arctic tern

Waterfowl:

- BMC Focal Species
  - Common eider (Pacific)
  - Black Brant (Pacific)
  - Greater Scaup
  - White-winged Scoter
- **Note – Sea Duck Joint Venture identified Long-tailed Duck as a High Priority Species in their 2014 Strategic Plan*

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Summary of Wildlife-Related Research on the Coastal Plain of the Arctic National Wildlife Refuge, Alaska, 2002–17

Open-File Report 2018–1003

U.S. Department of the Interior
U.S. Geological Survey

0000005011

Summary of Wildlife-Related Research on the Coastal Plain of the Arctic National Wildlife Refuge, Alaska, 2002–17

By John M. Pearce, Paul L. Flint, Todd C. Atwood, David C. Douglas, Layne G. Adams, Heather E. Johnson, Stephen M. Arthur, and Christopher J. Latty

Prepared in cooperation with the U.S. Fish and Wildlife Service

Open-File Report 2018–1003

U.S. Department of the Interior
U.S. Geological Survey

0000005012

U.S. Department of the Interior
RYAN K. ZINKE, Secretary

U.S. Geological Survey
William H. Werkheiser, Deputy Director
exercising the authority of the Director

U.S. Geological Survey, Reston, Virginia: 2018

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Suggested citation:
Pearce, J.M., Flint, P.L., Atwood, T.C., Douglas, D.C., Adams, L.G., Johnson, H.E., Arthur, S.M., and Latty, C.J., 2018, Summary of wildlife-related research on the coastal plain of the Arctic National Wildlife Refuge, Alaska, 2002–17: U.S. Geological Survey Open-File Report 2018–1003, 27 p., https://doi.org/10.3133/ofr20181003.

ISSN 2331-1258 (online)

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Conversion Factors

U.S. customary units to International System of Units

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

International System of Units to U.S. customary units

Multiply	By	To obtain
	Length	
meter (m)	3.281	foot (ft)
meter (m)	1.094	yard (yd)
kilometer (km)	0.6214	mile (mi)
kilometer (km)	0.5400	mile, nautical (nmi)
	Area	
square kilometer (km^2)	0.3861	square mile (mi^2)
	Flow rate	
meter per year (m/yr)	3.281	foot per year ft/yr)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32.$$

0000005015

Summary of Wildlife-Related Research on the Coastal Plain of the Arctic National Wildlife Refuge, Alaska, 2002–17

By John M. Pearce,[1] Paul L. Flint,[1] Todd C. Atwood,[1] David C. Douglas,[1] Layne G. Adams,[1] Heather E. Johnson,[1] Stephen M. Arthur,[2] and Christopher J. Latty[2]

Abstract

We summarize recent (2002–17) publicly available information from studies within the 1002 Area of the Arctic National Wildlife Refuge as well as terrestrial and coastal ecosystems elsewhere on the Arctic Coastal Plain that are relevant to the 1002 Area. This report provides an update on earlier research summaries on caribou (*Rangifer tarandus*), forage quality and quantity, polar bears (*Ursus maritimus*), muskoxen (*Ovibos moschatus*), and snow geese (*Chen caerulescens*). We also provide information on new research related to climate, migratory birds, permafrost, coastal erosion, coastal lagoons, fish, water resources, and potential effects of industrial disturbance on wildlife. From this literature review, we noted evidence for change in the status of some wildlife and their habitats, and the lack of change for others. In the 1002 Area, muskox numbers have decreased and the Porcupine Caribou Herd has exhibited variation in use of the area during the calving season. Polar bears are now more common on shore in summer and fall because of declines in sea ice in the Beaufort Sea. In a study spanning 25 years, there were no significant changes in vegetation quality and quantity, soil conditions, or permafrost thaw in the coastal plain of the 1002 Area. Based on studies from the central Arctic Coastal Plain, there are persistent and emerging uncertainties about the long-term effects of energy development for caribou. In contrast, recent studies that examined direct and indirect effects of industrial activities and infrastructure on birds in the central Arctic Coastal Plain found little effect for the species and disturbances examined, except for the possibility of increased predator activity near human developments.

Background

In 2002, the U.S. Geological Survey (USGS) published a summary of terrestrial wildlife research that was conducted from the 1980s to 2001 in northeastern Alaska, including the 1002 Area of the Arctic National Wildlife Refuge (Douglas and others, 2002). The report focused primarily on wildlife within the 1002 Area, but also included information from adjacent areas of the Arctic Coastal Plain where oil development took place during the preceding 30 years. Since that report was published, the Arctic has continued to warm at more than twice the global rate (Intergovernmental Panel on Climate Change, 2014) and some wildlife species and habitats are responding to climate-induced alterations that include loss of summer sea ice and permafrost thaw, as well as altered nutrient and hydrologic cycling (Chapin and others, 2014; Marcot and others, 2015; Van Hemert and others, 2015).

[1] U.S. Geological Survey, Alaska Science Center
[2] U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge

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There has also been renewed interest in oil and gas development across the Arctic Coastal Plain of Alaska and offshore in the Outer Continental Shelf region of the Chukchi and Beaufort seas. As a result, substantial research has been conducted in the region in recent years to better understand the mechanisms driving changes in animal abundance and distribution, to provide scientific information for natural resource management agencies, and to guide energy development while reducing potential effects on wildlife and habitat.

Here, we provide an update of Douglas and others (2002) by summarizing recent (2002–17) scientific literature from studies within the 1002 Area of the Arctic National Wildlife Refuge and from terrestrial and coastal ecosystems elsewhere on the Arctic Coastal Plain of Alaska that are relevant to the 1002 Area. This report is organized using the same section titles that appeared in Douglas and others (2002), as well as new sections that describe related wildlife and habitat research within or adjacent to the 1002 Area. The new sections include climate, migratory birds, permafrost, coastal erosion, coastal lagoons, fish, and water resources. In the caribou and migratory bird sections, we summarize recent studies regarding the potential effects of industrial disturbance on wildlife. This report also updates and complements information presented in a USGS report on the natural resources and science needs in the Arctic Outer Continental Shelf region (Holland-Bartels and Pierce, 2011).

Study Area

The 1002 Area of the Arctic National Wildlife Refuge is a 1,500,000 acre (6,100 km^2) area in northeastern Alaska (fig. 1). The approximate boundary of the 1002 Area is bounded on the north by the Beaufort Sea, on the west by the Canning River, and the east by the Aichilik River. The southern boundary follows the approximate 1,000-foot (305-m) elevation contour (Clough and others, 1987). The area is predominantly coastal tundra and upland habitat, often referred to as the ‘coastal plain’, and includes offshore barrier islands and lagoons (fig. 1). The 1002 Area comprises about 75 percent of the total coastal plain of the Arctic National Wildlife Refuge (Clough and others, 1987). Additional study area details can be found in Douglas and others (2002) and U.S. Fish and Wildlife Service (2015a).

Climate conditions of the 1002 Area and surrounding region have changed over recent decades. Jorgenson and others (2015a) reported that the mean annual temperature at the Kuparuk weather station, 190 km west of the 1002 Area, increased by 2.5 °C between 1984 and 2009. Gustine and others (2017) determined that from 1970 to 2013, average air temperatures during the growing season along the Dalton Highway, from the Brooks Range to Prudhoe Bay, showed long-term upward trends, with the greatest increase recorded in the coastal plain near Prudhoe Bay. The rapid increase in May air temperature has driven a trend in markedly earlier snow melt dates, which advanced by about 10 days between 1941 and 2004, leading to a longer growing season (Hinzman and others, 2005). Gustine and others (2017) also determined that day of spring ground thaw (≥0 °C) occurred 8 days earlier (range = 2–13 days) and the length of the vegetation growing season was 11 days longer (range = 0–20 days) in 2013 than in the 1970s. Warmer air temperatures have been accompanied by warmer near-surface water temperatures along the coast, which increased by 1.0–1.5 °C from 2007 to 2011 relative to the 1982–2011 long-term mean (Stroeve and others, 2014). Warmer air and ocean temperatures have altered sea ice extent and phenology, causing the annual number of days the southern Beaufort Sea was covered by ice to decrease at a rate of -17.5 days per decade from 1979 to 2014 (Stern and Laidre, 2016). Since the late 1990s, the mean duration of the open-water season (that is, period of time when sea ice is largely absent from the biologically productive continental shelf) has increased by 36 days (Atwood and others, 2016).

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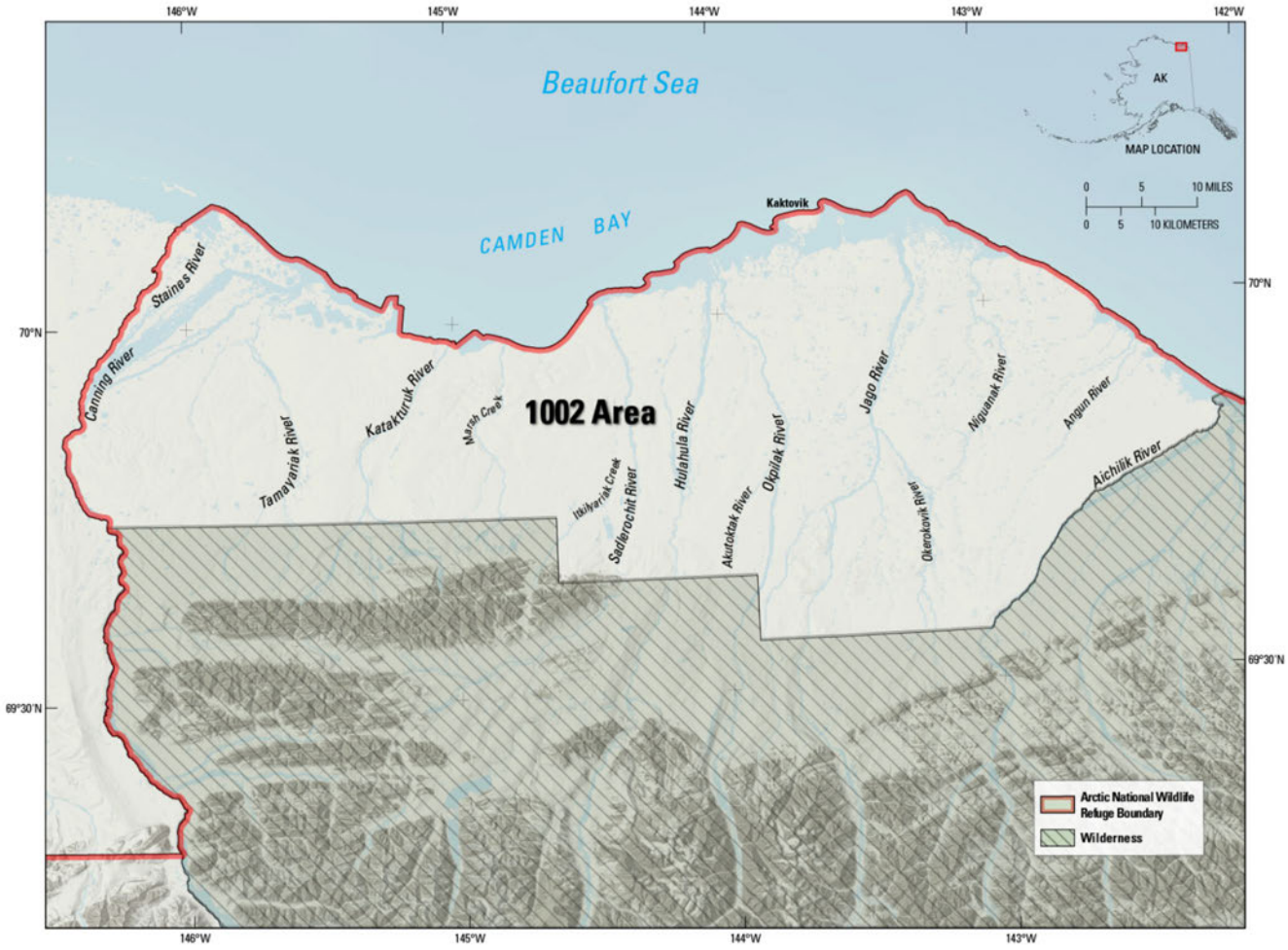


Figure 1. Map of 1002 Area showing approximate boundaries and main rivers, Arctic National Wildlife Refuge, Alaska. Detailed land ownership is not shown. Data source: Bureau of Land Management and Bureau of Ocean Energy Management.

Urban and Clow (2017) provide climate monitoring data collected from August 1998 to July 2015 from an array of 16 monitoring stations across the North Slope of Alaska that span latitude 68.5°N. to 70.5°N. and longitude 142.5°W. to 161°W. Three of the monitoring stations (Niguanak, Marsh Creek, and Camden Bay) are in the 1002 Area. Data collection at these stations is ongoing and includes the following climate- and permafrost-related variables: air temperature, wind speed and direction, ground temperature, soil moisture, snow depth, rainfall totals, up- and downwelling shortwave radiation, and atmospheric pressure.

Land Cover

The land-cover map in Jorgenson and others (2002) has not been updated for the 1002 Area, but there have been new releases of land cover information for the entire state of Alaska and North Slope region (Jorgenson and Heiner, 2003; Jorgenson and Grunblatt, 2013; Boggs and others, 2016; Raynolds and others, 2017). Nevertheless, the Jorgenson and others (2002) product remains the highest spatial resolution digital land cover map for the 1002 Area.

Porcupine Caribou Herd

The Porcupine Caribou Herd migrates between Alaska and the Yukon and Northwest Territories of Canada (fig. 2; Caikowski, 2015). Detailed information on herd range characteristics can be found in U.S. Fish and Wildlife Service (2015a). Griffith and others (2002) reported the herd size as 123,000 in 2001. Estimates of population size for the Porcupine Herd were not available between 2002 and 2009, but photocensuses in 2010, 2013, and 2017 demonstrated an increasing trend in population estimates with 169,000, 197,000, and 218,457 caribou counted, respectively (McFarland and others, 2017; Alaska Department of Fish and Game, 2018).

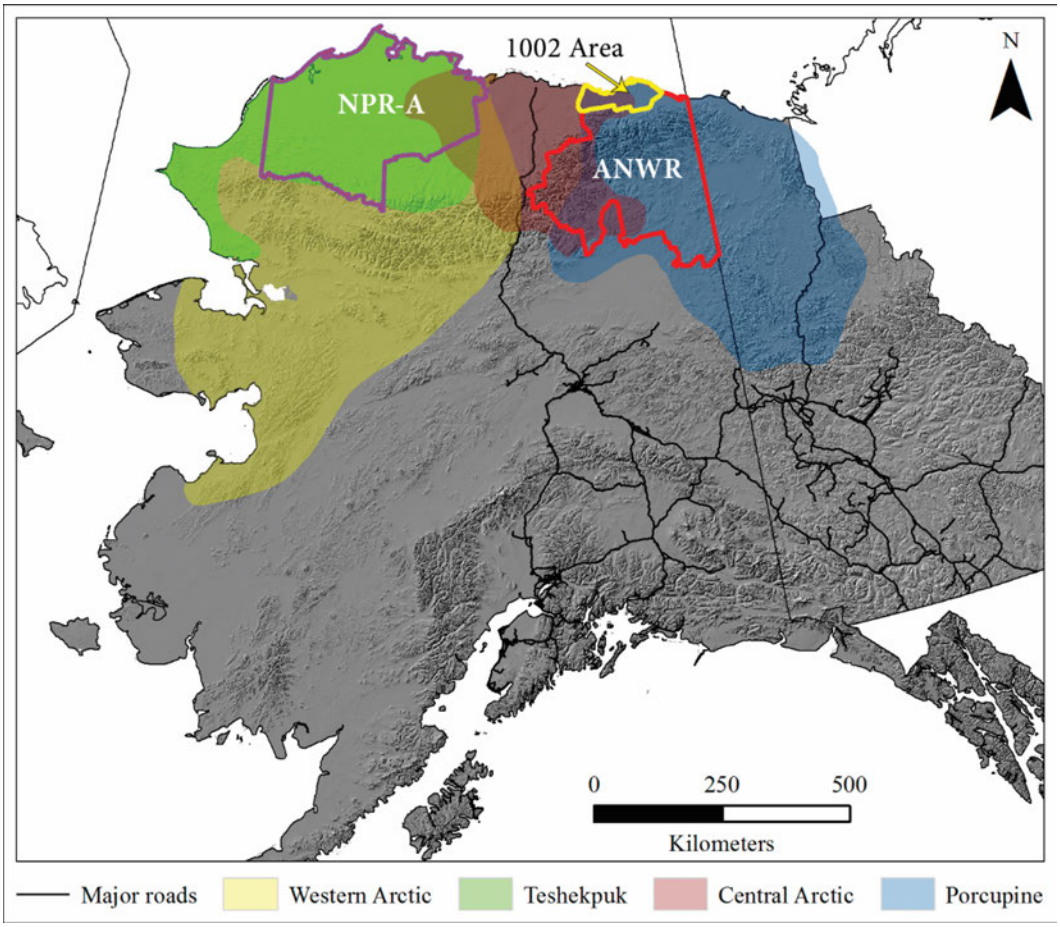


Figure 2. Map of approximate annual distributions of northern caribou herds in Alaska and Canada and approximate boundaries of the National Petroleum Reserve (NPR-A) and 1002 Area, Arctic National Wildlife Refuge (ANWR), Alaska.

According to Griffith and others (2002) and Harper and McCarthy (2015), much of the Porcupine Herd calved in the Arctic National Wildlife Refuge (often in the 1002 Area) during most years from 1983 to 2001, although some caribou calved in Canada in 1991 and calving areas shifted entirely into Canada in 2000 and 2001 (U.S. Fish and Wildlife Service, 2015a). Maps generated by the U.S. Fish and Wildlife Service (2015a) and McFarland and others (2017) show and discuss calving areas from 2002 to 2017. During these years, Porcupine caribou calving areas vary in location on the coastal plain of northeastern Alaska and northwestern Canada, with animals concentrated in Alaska in some years (2002–03, 2005, 2010, and 2016) and in Canada in others (2004, 2006–07, 2009, and 2011–13). Distribution maps show that caribou appeared to calve in both Alaska and Canada in 2008, 2014–15, and 2017 (U.S. Fish and Wildlife Service, 2015a; McFarland and others, 2017). During several of these years (for example, 2000 and 2001) the shift in calving distribution may have been a response to delayed snow melt on the coastal plain of Alaska (Arthur and Del Vecchio, 2017). The U.S. Fish and Wildlife Service (2015a) concludes that the annual variability in calving area indicates that the Porcupine Caribou Herd needs a large region from which the best conditions for calving can be selected in a given year. The Porcupine Caribou Herd uses the 1002 Area during the post-calving period, but little of this information is publicly available.

Miller and others (2013) determined the abundance of caribou bone and antler specimens of various ages to suggest patterns of caribou use of the coastal plain of the Arctic National Wildlife Refuge over many decades. These data corroborate observed changes in caribou distribution during the period of aerial monitoring (1983–2017).

Central Arctic Caribou Herd

Prior to 2001, the Central Arctic Caribou Herd spent little time in the 1002 Area and was included in Douglas and others (2002) only as an assessment of the possible effects of oil development on the Porcupine Caribou Herd. Since then, Nicholson and others (2016) published a paper on the annual movements of the herd from 2003 to 2007, and determined that portions of the 1002 Area were used by the Central Arctic Caribou Herd in some years (fig. 2).

The population size of the Central Arctic Caribou Herd increased from 1997 to 2008 at an average rate of approximately 10–13 percent per year before dropping from a high of 70,000 animals in 2010 to approximately 22,000 animals in 2016 (Taras and McFarland, 2016). The Alaska Department of Fish and Game reports that the two major contributing factors to the decline between 2013 and 2016 were high adult female mortality (approximately 50 percent of radio-collared caribou died) and animals switching herds (nearly 20 percent of radio-collared animals were found in either the Porcupine or Teshekpuk herds during the 3-year period; Taras and McFarland, 2016). The authors considered whether the population decline was influenced by range quality, the impact of oil infrastructure, calf production, adult sex ratio, predation, or disease. The authors discuss details for each of these factors and note that research continues into the possible role of these factors in population dynamics of the Central Arctic Caribou Herd. Also relevant to the Central Arctic Herd was a recent study by Gustine and others (2017) that determined that the quality (percent nitrogen) of summer forage for caribou on the coastal plain had not significantly changed between 1977 and 2011–2013 during peak parturition or lactation.

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Currently (2017), oil and gas development occurs in the calving and summer ranges of the Central Arctic Caribou Herd and the adjacent Teshekpuk Caribou Herd, and has been proposed within the calving and summer range of the Porcupine Caribou Herd. Thus, there are persistent and emerging questions about the effects of indirect habitat loss, displacement of caribou from key calving grounds, and the ability of caribou to move between foraging areas and insect-relief habitat, and ultimately, the influence of these factors on caribou population dynamics (Nellemann and others, 2003). Given these questions, management agencies and energy companies need information about the behavioral effects of development on caribou, whether behavioral responses diminish over time as individuals habituate, and if those responses subsequently influence caribou demographic rates.

The above-ground footprint of oil development within Prudhoe Bay rapidly expanded in the late 1970s and 1980s, with modest increases during more recent years. Studies on the behavioral responses of Central Arctic Herd during the 1980s and early 1990s have indicated that densities of calving caribou declined near roads and as road density increased; calving areas shifted away from infrastructure; and movements between foraging and insect-relief areas were inhibited by roads and pipelines (Smith and Cameron, 1985; Cameron and others, 1992, 1995; Nellemann and Cameron, 1998). In subsequent studies, Pollard and others (1996) determined that caribou densities during the post-calving season (July and August) were approximately ten-fold greater in the vicinity of Prudhoe Bay when relative insect activity was moderate or high, and that some caribou used elevated roads and well pads for insect relief. Haskell and others (2006) speculated that among-year changes in the caribou distribution within 1 km of roads may have been due to partial habituation to infrastructure. All these studies were largely based on data from aerial or road surveys, where the limited frequency (for aerial surveys) and spatial distribution (for road surveys) of data collection potentially introduced bias (Joly and others, 2006). As a result, studies over broader spatial scales and longer time frames are needed to reliably identify important habitats near potential energy infrastructure (Wilson and others, 2012) and understand the cumulative effects of oil and gas development on caribou, including the possibility of habituation to infrastructure and other human disturbances (Johnson and Russell, 2014).

Arthur and Del Vecchio (2009) tested for differences in calf growth and survival between the less-developed eastern and more industrialized western calving ranges of the Central Arctic Herd (see fig. 1 of Arthur and Del Vecchio, 2009). From 2001 to 2007, the authors observed that birth mass and skeletal growth of calves was higher in less-developed areas, but that calf survival did not differ between the two areas. Although the power to detect changes in demographic rates was limited by sample size, the authors suggested their findings may be evidence that caribou using the less-developed eastern area were in better condition. However, the authors stated that because of other changes (density dependence, shifting distributions, and habitat conditions) that took place in the summer range during the period of oil development, differences between western and eastern areas do not necessarily imply effects of industrial activity, and that there is sufficient variability in habitat quality across the range of the Central Arctic Herd to affect calf size, which may in turn influence calf recruitment into the population.

Nicholson and others (2016) developed movement models of the Central Arctic Caribou Herd to estimate and quantify summer and winter ranges of adult females, to assess annual variation in these ranges, and to identify areas used during spring and fall migration. The authors determined considerable variation in range use during 4 years of monitoring and suggested that the high variability indicates that caribou may have altered their use of winter range based on inter-annual differences in winter weather, snow cover, forage characteristics, or other factors. The authors also found that caribou movements during 4 years of migration were too variable to enable use of a single model that could adequately describe movements of all individuals. Caribou migration routes used during this study varied among years, but some areas of concentrated use (“bottlenecks”) were used consistently by large numbers of caribou in all years. Nicholson and others (2016) suggested that these migration bottlenecks should be managed to provide for continued access by caribou.

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Forage Quantity and Quality

Two recent studies examined changes in forage quantity and quality for ungulates and overall vegetation characteristics in the 1002 Area. First, Arthur and Del Vecchio (2013) examined fecal, soil, and vegetation samples collected during July 2009 to determine the role of forage quality in the decrease of muskoxen in northeastern Alaska. No differences were detected in mean concentrations of most mineral nutrients in soil and plant samples from sites used by muskoxen from 2007 to 2009 compared to sites that were used prior to 2006, but not in subsequent years. However, mineral concentrations of copper (Cu) in wideleaf polargrass (*Arctagrostis latifolia*) were well below minimum levels required for livestock and concentrations of zinc (Zn) in willow (*Salix alaxensis*) exceeded maximum levels recommended for livestock (Arthur and Del Vecchio, 2013).

Second, Jorgenson and others (2015a) summarized 25 years of vegetation plot data in the 1002 Area. This study monitored plant cover at 27 plots in 7 different years during 1984–2009 between the Katakturuk and Aichilik Rivers and quantified cover of all plant species and assessed change over time. Overall, the authors found that vegetation in the plots changed little in contrast to results from other studies in northern Alaska (see references in Jorgenson and others, 2015a). For the few plots with differences over time, the authors attributed the change to subsidence from thawing ground ice or floodplain dynamics. Jorgenson and others (2015a) remarked that the lack of an increasing trend in shrub cover in study plots was unexpected as this type of vegetation transition is occurring in many other parts of northern Alaska.

Predators

In Douglas and others (2002), the geographic distribution of golden eagle (*Aquila chrysaetos*) nest sites, wolves (*Canis lupus*), and brown bears (*Ursus arctos*) within and adjacent to the 1002 Area were surveyed and mapped. Eagle and wolf distributions were based on aerial surveys and brown bear distributions were based on annual locations of radio-collared bears during the first week of June from 1983 to 1994. There has been no update of this information for the 1002 Area since 2002.

Muskoxen

The population of muskoxen in northeastern Alaska (Colville River east to the Canadian border) declined from a peak of 700 animals in 1995 to approximately 216 in 2006 (Arthur and Del Vecchio, 2013; Afema and others, 2017). Within just the coastal plain of the Arctic National Wildlife Refuge, muskoxen virtually disappeared by 2006 between the Canning River and the Canadian border (Arthur and Del Vecchio, 2017). The population decline was less severe (35 percent) between the Colville River and the Canning River. According to Afema and others (2017) there are no known observed climatic, anthropogenic, or other environmental influences that provide a plausible explanation for the observed population decline of muskoxen in northeastern Alaska. Arthur and Del Vecchio (2017) state that the availability of moose and caribou calves as prey for brown bears was greatly reduced because of a moose population decline in the mid-1990s and a shift in the calving distribution of the Porcupine Caribou Herd to areas farther east in northern Canada during 2000 and 2001. Thus, Arthur and Del Vecchio (2017) suggest that reduced availability of other prey species may have caused some bears to focus predation on muskoxen, thus potentially contributing to the muskox population decline. Although predation by brown bears was the most common cause of death for muskox calves, the population decline was likely caused by a combination of factors acting in combination with predation, including disease, poor nutrition, low calf productivity and recruitment as well as poor survival of adults (Arthur and Del Vecchio, 2017).

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Afema and others (2017) found evidence for multiple diseases that potentially contributed to the mortality of muskoxen. Afema and others (2017) concluded that the northeastern muskox population was adversely affected by complex nutritional and infectious disease dynamics resulting in comorbidity that also likely increased susceptibility to predation. Analysis of fecal, soil, and vegetation samples collected between 2007 and 2011 by Arthur and Del Vecchio (2013) indicate that grasses and sedges were the most common forage types for both coastal and more inland muskox groups. There was some evidence of differences in diet between coastal and inland groups, but sample sizes were insufficient for meaningful statistical comparisons.

Polar Bears

Polar bears of the Southern Beaufort Sea subpopulation historically spent the entire year on the sea ice, with the exception of a relatively small proportion of adult females that would come ashore during autumn and enter maternity dens. However, over the last two decades, the southern Beaufort Sea has experienced a marked decline in summer sea ice extent, along with a pronounced lengthening of the melt season (period of time between sea ice break-up and freeze-up; Stroeve and others, 2014; Stern and Laidre, 2016). The dramatic changes in the extent and phenology of sea ice habitat during summer and prior to denning have coincided with evidence suggesting that use of terrestrial habitat has increased, including in the Arctic National Wildlife Refuge 1002 Area.

Schliebe and others (2008) determined that an average of 4 percent of the Southern Beaufort Sea subpopulation of polar bears was on land in a given autumn during 2000–2005, and that the percentage increased when sea ice was farther from the coast. More recently, Atwood and others (2016) determined that the percentage of radio-collared adult females coming ashore in summer and fall increased from 5.8 to 20 percent between 2000 and 2014. Over the same period, the mean duration of the open-water season (the period when <15 percent of the continental shelf is covered by ≥15 percent concentration sea ice) increased by 36 days and the mean length of stay on land by polar bears increased by 31 days (Atwood and others, 2016). While on shore, the distribution of polar bears is largely influenced by the opportunity to feed on the remains of subsistence-harvested bowhead whales aggregated at 3 sites along the coast, including adjacent to the community of Kaktovik (Rogers and others, 2015; McKinney and others, 2017; Wilson and others, 2017) (fig. 3).

In addition to using land as refugia during the open-water season, Southern Beaufort Sea polar bears have increasingly used land for maternal denning. Olson and others (2017) examined the choice of denning substrate (land compared to sea ice) by adult females between 1985 and 2013 and determined that the frequency of land-based denning increased over time, constituting 34.4 percent of all dens from 1985 to 1995, 54.6 percent from 1996 to 2006, and 55.2 percent from 2007 to 2013. Additionally, the frequency of land denning was directly related to the distance that sea ice retreated from the coast. From 1985–1995 and 2007–2013, the average distance from the coast to 50 percent sea ice concentration in September (when sea ice extent reaches its annual minimum) increased 351±55 km, while the distance to 15 percent sea ice concentration increased by 275±54 km. Rode and others (2018) determined that reproductive success was greater for females occupying land-based dens compared to ice-based dens, which may be an additional factor contributing to the increase in land-based denning. Land-based dens are mostly distributed along the central and eastern coast of Alaska's Beaufort Sea, which includes the 1002 Area (Durner and others, 2010; fig. 4). Durner and others (2006) estimate there is approximately 3,020 linear kilometers of suitable denning habitat within the 1002 Area (fig. 5).

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Collectively, these results suggest that the use of land by polar bears as summer refugia and for denning in winter will likely continue to increase with additional loss of sea ice. Although the effects that increased land use may have on nutrition, energetics, and reproduction are not fully understood, it is worth noting that the Southern Beaufort Sea subpopulation of polar bears has experienced a recent decline in abundance (Bromaghin and others, 2015). Increased frequency of bears on land, coupled with expanding human activities, is expected to lead to greater human-polar bear interaction and conflict (Atwood and others, 2016). The increased numbers of bears on land in the vicinity of Kaktovik has also led to a dramatic increase in popularity of commercially guided polar bear viewing. This industry was virtually non-existent in Kaktovik before 2006, but through 2016 more than 2,300 viewer-trips were recorded during the 61-day commercial viewing season (some viewers may have participated in multiple trips; Reed and Duplisea, 2017). This use greatly exceeds the total use by all other recreational activities in the Arctic National Wildlife Refuge.

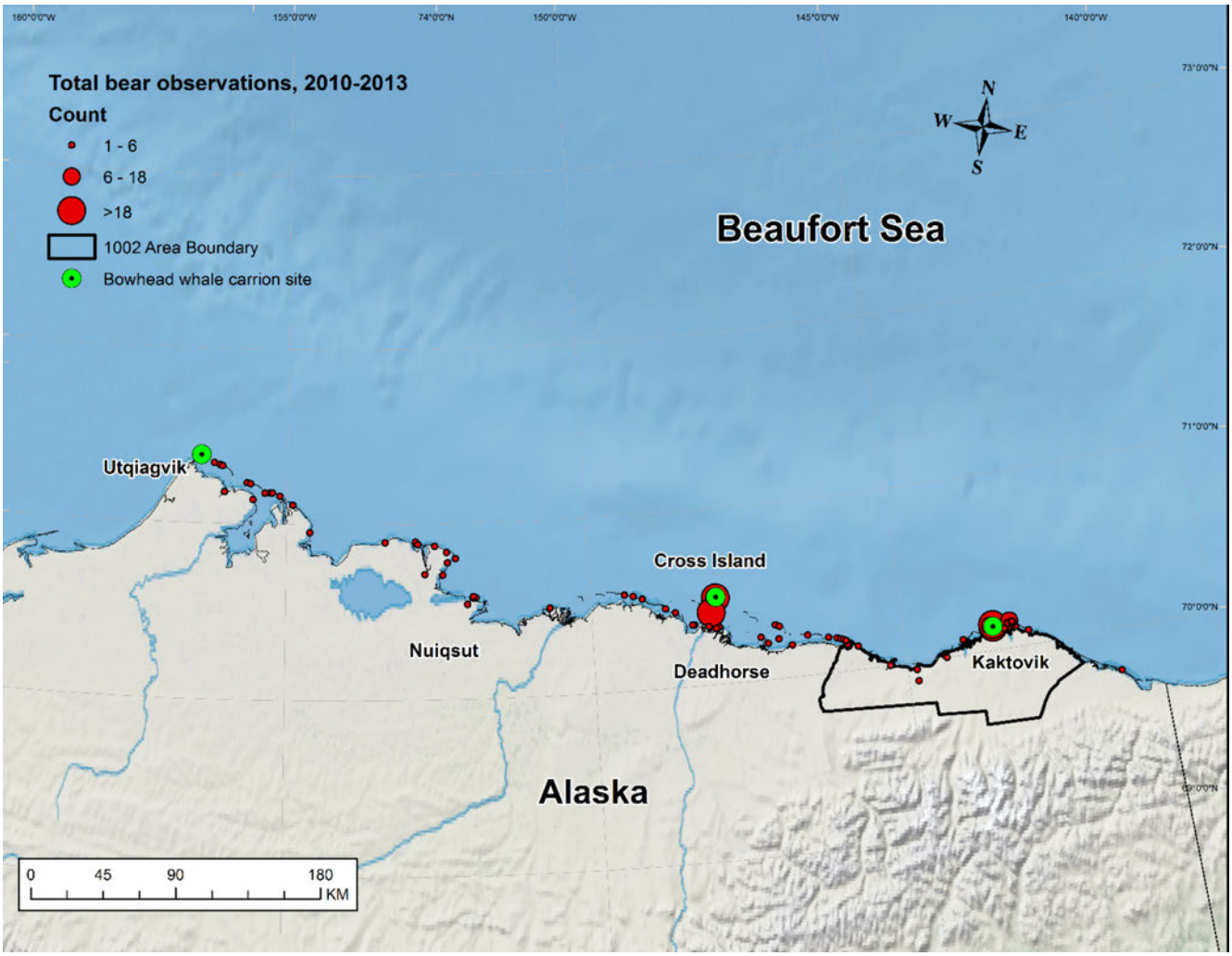


Figure 3. Map showing distribution of polar bears observed from 2010 to 2013 during autumn aerial surveys along the north coast, Alaska. The black line shows the approximate boundary of the 1002 Area, Arctic National Wildlife Refuge. (Adapted from Atwood and others, 2016).

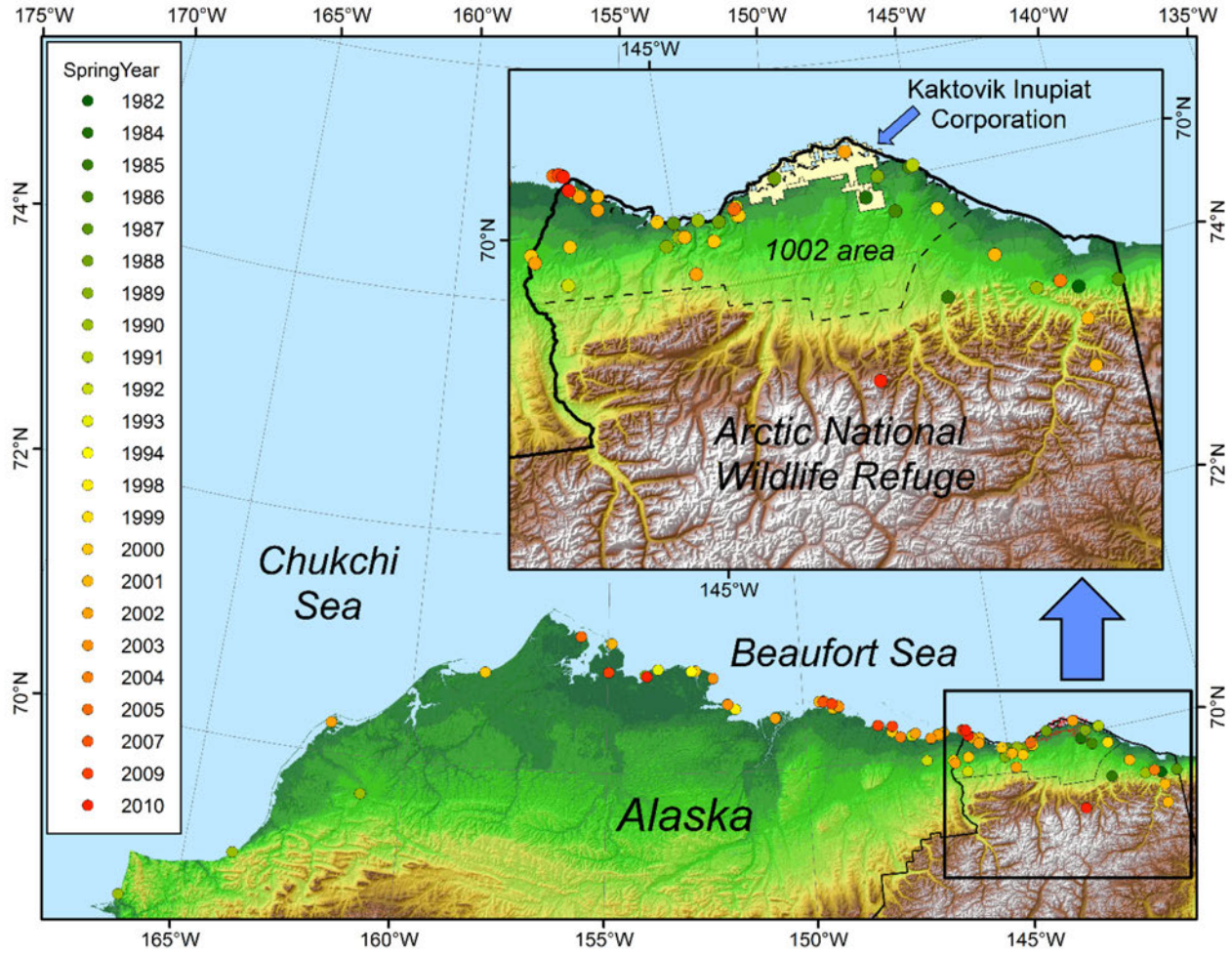


Figure 4. Map showing polar bear maternal dens on land or fast ice discovered with very high frequency (VHF) or satellite telemetry along north coast, Alaska, 1982–2010. Polar bears den during winter and "Spring Year" denotes the year the den was exited. The dashed line shows the approximate boundary of the 1002 Area, Arctic National Wildlife Refuge, Alaska.

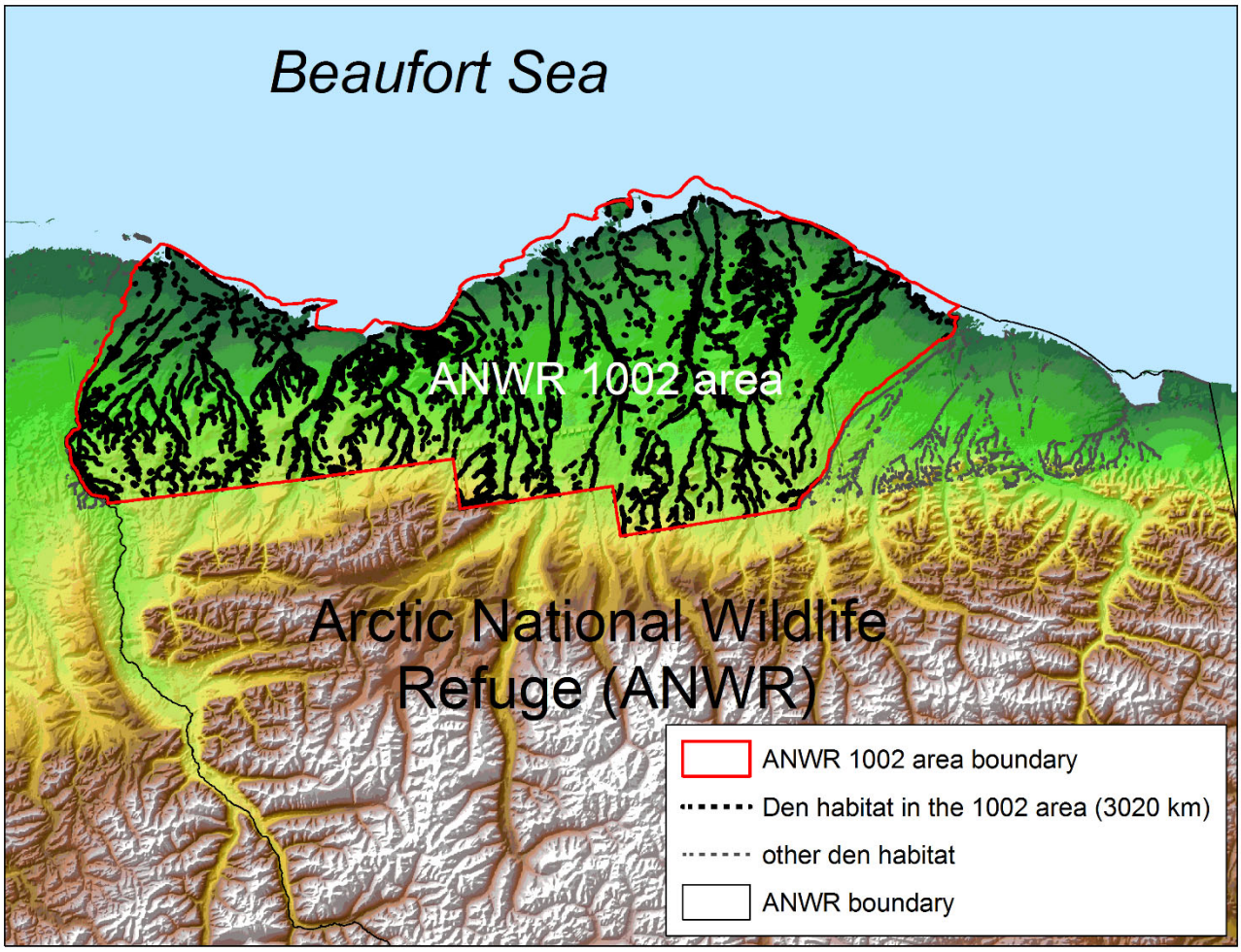


Figure 5. Map showing estimate of suitable polar bear maternal denning habitat within the approximate boundary of the 1002 Area, Arctic National Wildlife Refuge, Alaska. (Based on Durner and others, 2006).

Snow Geese

Snow geese are one of the most abundant bird species in the 1002 Area, but use is mostly for autumn staging after the breeding season. The Arctic National Wildlife Refuge is part of a larger staging area that extends east from the U.S. and Canadian border for approximately 500 km along the Arctic Coastal Plain to the Bathurst Peninsula of Canada. Snow geese that use the coastal staging area mainly originate from nesting areas on Banks Island in Canada. That population has increased to about 500,000 breeding individuals from the 200,000 birds present in the early 1990s (Pacific Flyway Council, 2013). Elsewhere on the Arctic Coastal Plain of Alaska, the number of breeding snow geese is rapidly increasing (Burgess and others, 2017; Hupp and others, 2017). Burgess and others (2017) suggest that some of the increase in Alaska may be due to immigration of snow geese from expanding breeding populations in the Canadian Arctic.

Since 1986, the U.S. Fish and Wildlife Service Migratory Bird Management Office has conducted annual aerial surveys of the Arctic Coastal Plain to generate indices of nesting waterbird population size and trends over time (Stehn and others, 2013). The 1002 Area is within the low bird density strata with transects that are widely spaced resulting in low power to detect clumped distributions of birds, such as snow geese that nest in colonies. There is uncertainty regarding current population status of snow geese staging within the 1002 Area. Maximum counts of autumn staging snow geese made in most years between 1973 and 2004 through a variety of survey methods are summarized by the U.S. Fish and Wildlife Service (2015a). In 2004, the last survey for which data are available, a total of 189,636 birds was observed on the coastal plain. Given the overall increase in numbers of snow geese in Arctic Alaska and Canada, further increases in the use of autumn staging areas in the 1002 Area should be expected.

Additional Wildlife and Habitat Research

Migratory Birds

The U.S. Fish and Wildlife Service (2015b) lists a total of 201 migratory bird species for the entirety of the Arctic National Wildlife Refuge. The 201 species total is a cumulative number, generated over many years of observations and includes species that were only seen once and those seen frequently each year across the refuge. At least 57 species regularly occur as breeding, nonbreeding, or both in the 1002 Area (table 1). These are species recorded on the coastal plain or nearshore areas of the Beaufort Sea as “fairly common”, “common”, or “abundant”.

Table 1. List of 57 fairly common, common, and abundant breeding and nonbreeding bird species for the coast, inland, and barrier island and lagoon regions of the 1002 Area of the Arctic National Wildlife Refuge, Alaska.

[**Species**: Species names and order follows Chesser and others (2017). **Reference**: Source references used are: 1, Garner and Reynolds (1986); 2, Garner and Reynolds (1987); 3, Brown and others (2007); 4, Dau and Bollinger (2009); 5, U.S. Fish and Wildlife Service (2015b); 6, Kendall (2005). Generalized categories of abundance were used by most references since few quantitative surveys have been conducted in the 1002 Area. For Dau and Bollinger (2009), we did not include species with less than or equal to 15 average sightings per year (see table 2). In cases where habitat area is given as "coastal plain" by a reference, both coast and inland areas are included. Abbreviations: B, breeding, NB, non-breeding]

Species	Region within 1002 Area			Reference
	Coast	Inland	Barrier Islands and Lagoons	
Greater white-fronted goose (*Anser albifrons*)	NB	NB		1, 2, 5
Snow goose (*Anser caerulescens*)	NB	NB		1, 2, 5
Brant (*Branta bernicla*)	B, NB		NB	1, 2, 4
Cackling goose (*Branta hutchinsii*)	B, NB	B, NB		1, 2, 5
Tundra swan (*Cygnus columbianus*)	B, NB	B, NB		1, 2, 5, 6
American wigeon (*Mareca americana*)	NB			1
Northern pintail (*Anas acuta*)	B, NB	B, NB	NB	1, 2, 4, 5
Greater scaup (*Aythya marila*)	NB		NB	1, 4
King eider (*Somateria spectabilis*)	B, NB		NB	2, 4, 5
Common eider (*Somateria mollissima*)	NB		B, NB	1, 2, 4, 5, 6
Surf scoter (*Melanitta perspicillata*)			NB	1, 4
White-winged scoter (*Melanitta fusca*)	NB		NB	4, 5, 6
Long-tailed duck (*Clangula hyemalis*)	B, NB	B	NB	1, 2, 4, 5, 6
Red-breasted merganser (*Mergus serrator*)	NB	B	NB	1, 2, 4, 5, 6
Willow ptarmigan (*Lagopus lagopus*)	B, NB	B, NB		1, 2, 5
Rock ptarmigan (*Lagopus muta*)	B, NB	B, NB		1, 2, 5
Sandhill crane (*Antigone canadensis*)	NB			2
Black-bellied plover (*Pluvialis squatarola*)	NB			1, 2, 5
American golden-plover (*Pluvialis dominica*)	B, NB	B, NB		1, 2, 3, 5
Semipalmated plover (*Charadrius semipalmatus*)		B, NB		2, 5
Upland sandpiper (*Bartramia longicauda*)		B		5
Whimbrel (*Numenius phaeopus*)		NB		2
Ruddy turnstone (*Arenaria interpres*)	B, NB	B, NB		1, 2, 5
Stilt sandpiper (*Calidris himantopus*)	B, NB	B		1, 2
Sanderling (*Calidris alba*)	NB			2
Dunlin (*Calidris alpina*)	B, NB	B		1, 2, 3
Baird's sandpiper (*Calidris bairdii*)	B	NB		1, 2
Buff-breasted sandpiper (*Calidris subruficollis*)	B	B		1, 2
Pectoral sandpiper (*Calidris melanotos*)	B, NB	B, NB		1, 2, 3, 5, 6
Semipalmated sandpiper (*Calidris pusilla*)	B, NB	B, NB		1, 2, 3, 5
Western sandpiper (*Calidris mauri*)	NB			1, 2
Long-billed dowitcher (*Limnodromus scolopaceus*)	B, NB	B, NB		1, 2, 5
Red-necked phalarope (*Phalaropus lobatus*)	B, NB	B		1, 2, 3, 5
Red phalarope (*Phalaropus fulicarius*)	B, NB	B, NB		1, 2, 3, 5
Pomarine jaeger (*Stercorarius pomarinus*)	B, NB	B, NB		1, 2, 5

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Species	Region within 1002 Area			Reference
	Coast	Inland	Barrier Islands and Lagoons	
Parasitic jaeger (*Stercorarius parasiticus*)	NB	NB		1, 2, 5
Long-tailed jaeger (*Stercorarius longicaudus*)	B, NB	B, NB		1, 2, 5
Glaucous gull (*Larus hyperboreus*)	B, NB	NB	B, NB	1, 2, 4, 5, 6
Arctic tern (*Sterna paradisaea*)	NB	NB	B	1, 2, 5, 6
Red-throated loon (*Gavia stellata*)	B, NB		NB	1, 2, 4, 5, 6
Pacific loon (*Gavia pacifica*)	B, NB	B, NB	NB	1, 2, 4, 5, 6
Yellow-billed loon (*Gavia adamsii*)	NB		NB	2
Rough-legged hawk (*Buteo lagopus*)	NB	NB		2
Golden eagle (*Aquila chrysaetos*)	NB	NB		1, 2, 5
Snowy owl (*Bubo scandiacus*)	B, NB	B, NB		1, 2, 5
Short-eared owl (*Asio flammeus*)	B	B		1, 2, 5
Peregrine falcon (*Falco peregrinus*)	NB			2
Common raven (*Corvus corax*)		NB		2
Eastern yellow wagtail (*Motacilla tschutschensis*)	B	B, NB		1, 2, 5
Common redpoll[1] (*Acanthis flammea*)	B	B		1, 2, 5
Hoary redpoll[1] (*Acanthis hornemanni*)	B	B		1, 2, 5
Lapland longspur (*Calcarius lapponicus*)	B	B		1, 2, 5
Snow bunting (*Plectrophenax nivalis*)	B	B	B, NB	5, 6
American tree sparrow (*Spizelloides arborea*)		B		1, 2, 5
Savannah sparrow (*Passerculus sandwichensis*)	B	B		1, 2, 5
White-crowned sparrow (*Zonotrichia leucophrys*)		B		1

[1]Redpoll species were not differentiated in Garner and Reynolds (1986, 1987), but are split into two species here.

The only bird species listed under the provisions of the Endangered Species Act of 1973 that are known to occur in the 1002 Area are the threatened Alaska-breeding population of the Steller's eider (*Polysticta stelleri*) and threatened spectacled eider (*Somateria fischeri*). These species have populations in northern Alaska that range from 576 birds (292–859: 90-percent confidence interval [CI]) for the Steller's eider (Stehn and Platte, 2009) to an average index of 7,158 total birds (6,536–7,781: 90-percent CI) for spectacled eiders (Stehn and others, 2013). Steller's eiders are concentrated in the western portion of the Arctic Coastal Plain near Utqiaġvik (formerly Barrow); whereas spectacled eiders are more widely distributed across the Arctic Coastal Plain. The Steller's eider is listed as a "rare visitor" and is not known to breed in the 1002 Area. However, the spectacled eider is listed as a "rare breeder" on the coastal plain of the Arctic National Wildlife Refuge (U.S. Fish and Wildlife Service, 2015), but it is not known how many nests occur annually within the 1002 Area.

Since 1986, the U.S. Fish and Wildlife Service has conducted annual aerial surveys of much of the Arctic Coastal Plain of northern Alaska to generate indices of nesting waterbird population size and trends over time (Stehn and others, 2013). However, only about one-third of the 1002 Area is currently surveyed, and what is surveyed falls within the low-density strata. Surveys within the low-density strata have far fewer transects that are farther apart and thus have little power to detect and determine trends of breeding and non-breeding migratory birds.

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Bart and others (2013) used aerial and ground survey data to estimate distribution, abundance, and density of 3 groups of aquatic birds (waterfowl, loons, and grebes; shorebirds; and gulls, terns, and jaegers) across much of the Arctic Coastal Plain. They reported a west-to-east gradient of abundance and density of these 3 groups, with higher numbers in the west (National Petroleum Reserve - Alaska [NPR-A]), intermediate numbers in the central coastal plain (Prudhoe Bay), and lower numbers in the east (Arctic National Wildlife Refuge).

Kendall (2005) searched the barrier islands of the 1002 Area on foot in the summers of 2003–2004 and documented a total of 229 common eider nests. From 1999 to 2009, during late June and early July, Dau and Bollinger (2009) conducted aerial surveys in nearshore waters and along barrier islands of the Arctic Coastal Plain, including areas within the 1002 Area, to count common eiders (*Somateria mollissima*) and other waterbirds. A summary of average numbers of the most common waterbirds counted during these aerial surveys that occurred within the 1002 Area (survey segments 22–27) is presented in table 2. Additionally, Lysne and others (2004) conducted near-shore sea duck and loon aerial surveys in late July and early August of 2002 and 2003 along the coast of the Arctic National Wildlife Refuge. The authors documented similar species to Dau and Bollinger (2009), but observed thousands more long-tailed ducks (*Clangula hyemalis*) during the surveys.

Table 2. Average number per year of the 17 most common bird species observed from 1999 to 2009 on coastal lagoon and barrier island aerial surveys within the 1002 Area of the Arctic National Wildlife Refuge, Alaska.

[From U.S. Fish and Wildlife Service (Dau and Bollinger, 2009). **Species:** Species names and order follows Chesser and others (2017)]

Species	Average number
Brant (*Branta bernicla*)	45
Cackling goose (*Branta hutchinsii*)	12
Tundra swan (*Cygnus columbianus*)	7
Northern pintail (*Anas acuta*)	44
Greater scaup (*Aythya marila*)	179
King eider (*Somateria spectabilis*)	184
Common eider (*Somateria mollissima*)	593
Surf scoter (*Melanitta perspicillata*)	2,173
White-winged scoter (*Melanitta fusca*)	271
Long-tailed duck (*Clangula hyemalis*)	819
Red-breasted merganser (*Mergus serrator*)	306
Glaucous gull (*Larus hyperboreus*)	553
Arctic tern (*Sterna paradisaea*)	5
Red-throated loon (*Gavia stellata*)	15
Pacific loon (*Gavia pacifica*)	38
Yellow-billed loon (*Gavia adamsii*)	4

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Shorebirds

The Arctic Coastal Plain of Alaska is an important region for millions of migrating and nesting shorebirds. Brown and others (2007) conducted surveys of breeding shorebirds during June of 2002 and 2004. They encountered 14 shorebird species and estimated that 230,000 (95-percent CI: 104,000–363,000) shorebirds occupied the 1002 Area during the breeding season. Species richness and density were typically highest in wetland or riparian habitats and deltas (such as near the Canning River Delta). Johnson and others (2007) determined that shorebird species were more abundant in the coastal ecoregion (that is, closer to the coast rather than farther inland) and that across the entire Arctic Coastal Plain, species richness was highest in the western part of the Beaufort coastal plain. However, several species were more abundant in the east, reflecting longitudinal diversity. Johnson and others (2007) concluded that the distribution maps of their study would be helpful for documenting large-scale shifts in species ranges, but that more detailed habitat-based maps would be needed to document subtle changes in distribution.

Saalfeld and others (2013a) developed habitat suitability models for eight species of shorebirds across the Arctic Coastal Plain. Like Johnson and others (2007), they determined that the most suitable habitat was in the NPR-A, followed by the Arctic National Wildlife Refuge. The authors also noted that because habitat suitability maps depict areas with minimum habitat requirements for a given species, ground surveys should be conducted prior to establishing final recommendations for any future development to verify the use of an area by nesting shorebirds.

Taylor and others (2010) used aerial surveys of the entire northern coast of Alaska during summers of 2005–07 to locate concentrations of staging shorebirds and determine species richness and composition, seasonal phenology, and habitat selection. The authors noted large concentrations of staging shorebirds on the Sagavanirktok and Kongakut river deltas. A comparison to data collected in the mid-1970s indicated that foraging habitat types used by staging shorebirds were largely unchanged through time. Taylor and others (2011) subsequently used radio transmitters on shorebirds to determine species movements and residence times on the Arctic Coastal Plain following the breeding season. Results demonstrated how different species use the northern Alaska coast and suggest that individuals use multiple post-breeding sites as they migrate eastward before ultimately moving south down the Central Flyway. Brown and others (2012) used a transect survey of Arctic National Wildlife Refuge river deltas, and determined that most of the deltas were used by large numbers of shorebirds during fall migration with the Jago River Delta being one of the highest use areas.

Churchwell and others (2016, 2017) examined the diversity and annual variation of benthic invertebrate communities within the Canning, Okpilak, Hulahula, and Jago river deltas in the coastal part of the 1002 Area. Churchwell and others (2016) found both freshwater and marine organisms were present and that species diversity was relatively low in comparison to river deltas at more southerly latitudes. The benthic resources provide food for large numbers of migratory shorebirds during the summer open-water period. Semipalmated sandpipers (*Calidris pusilla*) used the Jago River Delta in large numbers early in the migration (around August 1) and the Okpilak/Hulahula River Delta later in migration (around August 13; Churchwell and others, 2017). Based on analyses of stable isotopes in their diet, shorebirds fed on benthic invertebrates that were patchily abundant, but preferred prey were not always the most abundant invertebrate species present on a given delta (Churchwell and others, 2017). Accordingly, different invertebrate species were the apparent preferred prey at each delta.

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Disturbance to Birds from Industry and Investigators

A number of recent studies have examined direct and indirect effects of industrial activities to birds on the Arctic Coastal Plain. Saalfeld and others (2013b) examined productivity of nesting shorebird species in relation to the development of a landfill near Utqiaġvik and found that nest densities, nest survival, and return rates were generally greater inside than outside a fenced area surrounding the landfill. Bart and others (2013) examined aerial survey data within the Prudhoe Bay oil fields and maps of numbers recorded did not reveal any evidence that density of birds was lower near developed areas. The USGS studied waterfowl using the lagoons in the vicinity of Prudhoe Bay (considered an industrial area) and in an undisturbed reference area adjacent to the Arctic National Wildlife Refuge (Flint and others, 2003; Lacroix and others, 2003; Flint and others, 2016). Those studies indicated that although flocks responded strongly to disturbance stimuli, there was no clear effect of open water seismic industrial activity and other disturbance on habitat use or foraging behaviors by molting long-tailed ducks (*Clangula hyemalis*). The study also indicated there was no effect of industrial development on nesting common eiders (*Somateria mollissima*) with the possible exception of increased nest predation risk for common eiders nesting near oil fields.

Liebezeit and others (2009) quantified nest survival of shorebird and passerine species in relation to areas with and without industrial development across the Arctic Coastal Plain. The authors also investigated the abundance and effect of subsidized predators (those benefiting from an association with human development) and non-subsidized predators on the nesting success of prey species. The authors observed substantial natural variation in annual nest survival across years and study locations, leading the authors to conclude that a development effect, if present, may be small relative to the natural annual variability in the Arctic. The authors found no effect of industry on nesting success for shorebirds (the most abundant guild of nesting birds on the Arctic Coastal Plain), but did observe a decline in nest survival of passerine species (the second most abundant group of birds nesting on the Arctic Coastal Plain) within 5 km of infrastructure. Although predation events were determined to be the primary cause of nest failure, the authors found that predator abundance was not related to nest survival and non-subsidized predators accounted for 32–77 percent of the total predators observed during surveys.

Meixell and Flint (2017) also examined predators and distance to industrial disturbance in relation to nesting behavior and success of greater white-fronted geese (*Anser albifrons*). Additionally, these authors quantified the effect of observer visits to nests. This study indicated only minor effects of industrial activity on goose nest attendance patterns and no measurable impact of low-flying helicopters on nest attendance patterns of geese. Nest survival was low for greater white-fronted geese nesting closer to industrial activity, but only in the first of the 2-year study when the number of arctic fox (*Vulpes lagopus*) visits to nests and fox depredation events were higher. This was likely because foxes used buildings as a base from which to hunt nesting birds and their eggs. In a year with lower fox activity, there was no difference in nest survival for nests close to and farther from industrial activity. Human foot traffic directly approaching nests had the greatest impact to nest attendance patterns and nest survival of greater white-fronted geese. Results for observer effects are consistent with findings from other studies on the central Arctic Coastal Plain involving king eiders (*Somateria spectabilis*; Bentzen and others, 2008) and loons (Uher-Koch and others, 2015). Meixell and Flint (2017) conclude that these results demonstrate a differential response by nesting geese to varying types of disturbance. Whereas observer visits were associated with direct human encroachment at nests that caused female geese to be absent from nests longer, sources of industrial disturbance in their study were characterized primarily by vehicular, aircraft, and foot travel that followed similar routes and usually did not directly approach nest sites.

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Bentzen and others (2017) used real and artificial shorebird and waterfowl nests located along roads in industrial areas of the central Arctic Coastal Plain to evaluate the relationship between distance from infrastructure and bird nesting success. The study indicated no effect from infrastructure on nest survival in either real or artificial nests. However, only 18 percent of artificial shorebird nests and 4 percent of artificial waterfowl nests survived the entire study. Since these rates appear to be biased low relative to real nests, the authors caution about conclusions derived from artificial nests regarding development impacts and nest predators.

Permafrost

Permafrost in the Beaufort Sea coastal area, including the 1002 Area, is continuous and active layer depth varies depending upon local conditions (Kanevskiy and others, 2013). Based on long-term (1977–2003) permafrost measurements, Osterkamp (2005) reported that the magnitude of total warming at the surface of the permafrost was 3–4 °C for the Arctic Coastal Plain. Kanevskiy and others (2013) surveyed permafrost characteristics across the Arctic Coastal Plain, including 16 sites within the 1002 Area. They identified four main land forms within the 1002 Area including (1) the primary surface, composed of predominantly gravelly sand, (2) the Yedoma, defined as extremely ice-rich Pleistocene permafrost with eolian silt, (3) river deltas and tidal flats, and (4) eolian dunes of sand. All of these land forms had high levels of volumetric ice (>73 percent except for eolian sand which had 43 percent ice). The high ice content implies that these areas may be susceptible to subsidence associated with permafrost degradation. In areas of the NPR-A, Tape and others (2013) identified dramatic changes in vegetation characteristics apparently resulting from permafrost subsidence. As such, broad sections of the 1002 Area may see future changes in vegetation composition associated with permafrost degradation.

Jorgenson and others (2015a) found high variability and no significant trend in depth of the soil active layer above permafrost at their vegetation monitoring plots. Jorgenson and others (2015b) compiled a permafrost database to merge information on soil stratigraphy and laboratory data for 861 sites with boreholes, pits, and exposures where permafrost can be examined and monitored.

Farquharson and others (2016) examined the spatial distribution of thermokarst terrain in the western section of the Arctic Coastal Plain to determine which landscapes are most susceptible to thaw in the near future. The study determined that the coastal marine silts may be particularly susceptible to thaw, which has implications for ecosystem processes and human infrastructure near Utqiaġvik and in the NPR-A. Similar information has not been developed for northeastern Alaska. Permafrost temperatures from deep boreholes spread across the western Arctic Coastal Plain indicate a trend of warming in the near surface, likely as a result of warmer winters with more snowfall and warmer summers (Clow, 2014). Borehole measurements on the coastal plain of the Arctic National Wildlife Refuge showed that permafrost temperatures increased between 1985 and 2004, at a similar rate to other North Slope sites (Osterkamp and Jorgenson, 2006).

Coastal Erosion

With the recent declines in sea ice in the Beaufort Sea, coastal erosion has become widespread and may be accelerating along the Arctic coast of Alaska, and is transforming some coastal habitats. Gibbs and Richmond (2015, 2017) examined shoreline change along Alaska's Arctic coast between 1947 and 2012 and found coastal erosion to be widespread and a threat to defense and energy-related infrastructure, coastal habitats, and Alaska Native communities. Gibbs and Richmond (2015, 2017) applied standard, repeatable methods for mapping and analyzing shoreline change so that periodic, systematic, and internally consistent updates regarding coastal erosion and land loss can be made nationally. Gibbs and Richmond (2017) determined that the northern coast of Alaska is dominantly erosional, with 84 percent of the total transects showing shoreline retreat over the long term (1940s–

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2010s) and 77 percent in the short term (1980s–2010s). The greatest average erosional rates were measured between Cape Halkett and the Ikpikpuk River Delta within the NPR-A. The greatest average erosional rates for regions in the 1002 Area (Canadian border to Hulahula River and Hulahula River to Staines River) were lower (approximately -0.9 m/yr) than for areas in the NPR-A. According to Gibbs and Richmond (2015), observed and projected increases in periods of sea-ice free conditions suggest that Arctic coasts will be more vulnerable to storm surge and wave energy, potentially resulting in accelerated shoreline erosion and terrestrial habitat loss in the future.

Coastal Lagoons

Coastal lagoons of the southern Beaufort Sea support large numbers of fish and millions of migratory birds in the summer months. Dunton and others (2012) demonstrated a significant terrestrial carbon subsidy to the coastal lagoon ecosystem of the southern Beaufort Sea in northeastern Alaska. The authors found evidence for substantial energy transfer from terrestrial sources of carbon to zooplankton and benthic communities that in turn support higher trophic level organisms, such as waterfowl and fish, including Arctic cod. In 2017, a 5-year study began at a new Long-Term Ecological Research (LTER) site in northeastern Alaska along the Beaufort Sea coast that will focus on the ecological interactions between land and ocean in this region.

Fish

Arctic cisco (*Coregonus autumnalis*) and Dolly Varden (*Salvelinus malma*) are common fish species in coastal regions of northern Alaska. Freshwater habitats used by these and other fish species in the 1002 Area have been considered as potential water sources for future oil and gas development (Brown and others, 2014, and references therein). Brown (2008) quantified the long-term trends in demographic composition, relative abundance, and body condition of Arctic cisco and Dolly Varden in coastal lagoon systems of the 1002 Area near Barter Island during the years 1988–1991 and 2003–2005. Brown (2008) determined that abundance of mature-size Arctic cisco remained relatively stable between the early and late years of the study and that cisco encountered in the Barter Island region come from overwintering habitats in both the Colville and Mackenzie River deltas. Relative abundance of Dolly Varden remained stable across the study period. Additional information regarding other fish species is also discussed. Vivant (2009) provides aerial index counts of overwintering Dolly Varden from the Canning and Hulahula Rivers in 2007 and 2008. Counts varied substantially between years. For the Canning River, 3,936 and 7,533 fish were counted on the Canning River in 2007 and 2008, respectively. On the Hulahula River, 9,575 and 3,653 fish were seen in 2007 and 2008, respectively. Vivant cautions that these numbers should not be used to infer trends in abundance because of differences in survey methods, timing of fish migration, and annual variation.

Brown and others (2014) examined overwintering locations for Dolly Varden in perennial springs in rivers of the 1002 Area. Using radio transmitters, Brown and others (2014) found four discrete areas with perennial springs for overwintering Dolly Varden along the Hulahula River, with one of these occurring within the coastal plain of the 1002 Area. These four areas appear to represent all overwintering habitat in the Hulahula River drainage. Additionally, Brown and others (2014) determined that 20 percent of tagged fish moved to sites within the Canning, Aichilik, and Kongakut River drainages in subsequent years for overwintering.

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The U.S. Fish and Wildlife Service (2015) describes some of the 42 fish species found within the Arctic National Wildlife Refuge, not all of which occur in the 1002 Area. Thorsteinson and Love (2016) describe geographic distributions, life cycle schematics, and ecological information for 109 marine fish species of the Chukchi and Beaufort seas, including coastal and offshore regions of the 1002 Area. An on-going USGS research project is examining fish community composition in comparison to historical sampling in the 1980s and 1990s in the Beaufort Sea, including the coastal lagoons of the 1002 Area.

Water Resources

Understanding water resources in the 1002 Area informs questions related to multiple ecosystem components as well as possible infrastructure development. A USGS streamgage station was established October 1, 2010, on the Hulahula River (69°42'41"N., 144°11'24"W.) along a reach draining a 684 mi^2 watershed comprised of mountain, foothill, and coastal plain ecoregions. Air temperature, precipitation, and water levels are recorded and discharge is computed from a stage-discharge relationship. This is one of only five streamgages north of the Brooks Range, the only station within the Arctic National Wildlife Refuge, and the only site in the U.S. Arctic that measures streamflow from a glaciated watershed. More information is available at: https://waterdata.usgs.gov/ak/nwis/inventory/?site_no=15980000. Two additional USGS streamgages operated in the past. The Canning River station (69°52'55"N., 146°23'09"W.) operated from June 23, 2008, to September 29, 2012, and was located 338 ft above mean sea level along a reach draining 1,930 mi^2 of the Brooks Range and foothills. The Tamayariak River station (69°51'55"N., 145°35'34"W.) operated from June 1, 2008, to September 29, 2012, and was located 325 ft above mean sea level along a reach draining 149 mi^2 of the coastal plain. The Canning River discharged the highest volume of water with annual mean flow ranging from 1,502 to 1,961 cubic feet per second (ft^3/s) during the entire period of record. Annual mean flow on the Tamayariak ranged from 93.7 to 69.6 ft^3/s during the same period of record. Annual mean flow on the Hulahula River ranged from 489 to 745 ft^3/s from 2010 to 2016. The highest average monthly flows in the Canning and Tamayariak rivers occur during snowmelt in June. The highest average monthly flow in the glacier-fed Hulahula River, occurs during July.

Acknowledgments

We thank Beth Lenart (Alaska Department of Fish and Game), Jeff Conaway (U.S. Geological Survey [USGS]), Ann Gibbs (USGS), Brad Griffith (USGS), Jerry Hupp (USGS), Sarah Thompson (USGS), Vanessa Von Biela (USGS), John Buursma (USGS), Patrick Lemons (U.S. Fish and Wildlife Service [USFWS]), Greta Burkhart (USFWS), Roy Churchwell (USFWS), Janet Jorgenson (USFWS), Dave Payer (USFWS), Ted Swem (USFWS), Steve Kendall (USFWS), and Rick Lanctot (USFWS) for their reviews of this report. Mary Whalen (USGS) assisted with all figures.

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Publishing support provided by the U.S. Geological Survey
Science Publishing Network, Tacoma Publishing Service Center

For more information concerning the research in this report, contact the
Director, Alaska Science Center
U.S. Geological Survey
4230 University Drive
Anchorage, Alaska 99508
https://alaska.usgs.gov

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ISSN 2331-1258 (online)
https://doi.org/10.3133/ofr20181003

From:	Edward Decleva
To:	Fox, Joanna
Cc:	Stephen Arthur; christopher_latty@fws.gov; greta_burkart@fws.gov; Hollis Twitchell; Reed, Jennifer; Roger_Kaye@fws.gov; Rose, Joshua; Ted Swem; erin_carver@fws.gov; patrick_odell@fws.gov; randy_j_brown@fws.gov; Steve Berendzen; Sarah Conn; Lynnda Kahn; Wendy Loya; Stephanie Brady
Subject:	Re: Draft Seismic Exploration EA - Affected Environment
Date:	Thursday, May 17, 2018 8:36:53 AM

Hi Joanna,

This is the first I've heard of a Seismic Exploration EA. I was only aware of an overarching oil and gas EIS. b5-dp [redacted]

b5-dp [redacted]

[redacted]

[redacted]

Thank you, Ed

Edward J. DeCleva
Regional Historic Preservation Officer
U.S. Fish and Wildlife Service, Alaska Region
1011 E Tudor Rd, MS-235
Anchorage, AK 99503

edward_decleva@fws.gov
907-786-3399

On Wed, May 16, 2018 at 3:02 PM Joanna Fox <joanna_fox@fws.gov> wrote:

> Good morning,
>
> If you are receiving this message, you have either been identified as a lead member of the FWS Seismic Exploration Interdisciplinary Team, or as someone who has expertise that can assist in the development and review of the Environmental Assessment (EA) to analyze the impacts of seismic exploration in the Coastal Plain of the Arctic Refuge.
>
> Specifically, BLM is tasking the FWS team with the responsibility for writing Chapter 3 of the EA (Existing Condition, or what we usually refer to as the Affected Environment). The current proposed timeline has us drafting this Chapter from May 16 (today) through May 25. We anticipate the timeline is going to get bumped back, but not significantly. Therefore, we believe it is imperative that we start our work on this project immediately.
>
> To expedite and make this task as simple as possible, we propose we use the Draft Affected Environment chapter that was prepared last fall when we were tasked with changing the regulations for geological exploration of the 1002 area as a template. We are asking each of you to edit that document as you deem appropriate for this new proposed activity. Please

edit and add comments to the Google Doc where you have subject matter expertise. We will consider this our working draft. Also - if you feel there are Affected Environment categories that are missing, please add them where you think appropriate (for example: it may be worth adding special designations like Wild & Scenic Rivers and Marine Protected Areas).

As you work, please keep in mind that under the new Department NEPA direction, complex EAs will be required to be less than 50 pages in length (appendices are not included in the total page numbers). For this task, you should include the level of detail you deem appropriate for the resource you have expertise about, recognizing that you will be tasked with providing a summary of that resource for the body of the EA.

Thanks much for your assistance with this project! If you have any questions or need additional clarification, please let me know.

Joanna

_____

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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"Do what you can, with what you have, where you are." -- Theodore Roosevelt

From: Churchwell, Roy
To: Latty, Christopher
Subject: Re: Species of Conservation Conern
Date: Thursday, May 17, 2018 10:56:56 AM
Attachments: Species of special status_CL_RTC_Draft.docx

Hello Chris,

Both landbirds and shorebirds have nearly complete drafts that are close to finalized for their state conservation plans. The landbird plan has been stalled for years and it might not be possible to site it and so you might not be able to use it. There is a 1999 plan on line though. The shorebird plan has been chugging along and will most likely be done in early fall. Rick will have the latest on that. I don't have either of those lists at my fingertips, and so I just made a comment or two on species that I think might be on there, but I couldn't verify. Rick and Coleen Handle should be able to send us the info though. I also think Alaska Audubon's watchlist (http://ak.audubon.org/conservation/alaska-watchlist) could be helpful. It is well thought out and documented.

I didn't know what kind of input you were looking for in this document, and so I didn't make any changes to the content. I just added comments where I thought they might be helpful.

Roy

On Thu, May 17, 2018 at 12:00 AM, Latty, Christopher <christopher_latty@fws.gov> wrote:

> Hi Roy,
>
> BLM asked Steve Berendzen to provide a list of list similar to the BLM Special Status species list.
>
> I've attached my thoughts so far. I wanted to get your thoughts again before passing it around to the larger group. Please let me know your thoughts on the use of the lists outlined in the document and which of the various levels of conservation concern you think should be included from the various Conservation Plan lists.
>
> I'm headed out of town tomorrow till next Wednesday, so if there is any way you can look this over in the am that would be great.
>
> Thanks!
>
> Cheers
> Chris
>
> --
> Christopher Latty
> US Fish and Wildlife Service
> Arctic NWR
> 101 12th Avenue
> Room 236
> Fairbanks, AK 99701
> cell 907-347-4300

--
Christopher Latty
US Fish and Wildlife Service
Arctic NWR
101 12th Avenue
Room 236
Fairbanks, AK 99701
cell 907-347-4300

--
Roy Churchwell, PhD
Wildlife Biologist
US Fish and Wildlife Service
Kanuti National Wildlife Refuge
101 12th Ave. Room 206
Fairbanks, AK 99701
(907) 456-0450
https://www.fws.gov/refuge/kanuti/

We circulated the question of what lists are available for species of conservation priority for the Refuge Arctic Coastal Plain among the bird group and here is what we came up with.

There are several conservation priority lists for birds that would be applicable that have been developed by FWS or that are part of Conservation Plans that FWS was a partner on. There is also the Region 7 Priority Species list, but it's unclear if that is appropriate for this purpose.

The Birds of Conservation Concern (BCC) is a 2008 document by FWS. The purpose of that document was to "accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent our highest conservation priorities". Some issues with the plan are 1) it's now somewhat outdated, and 2) it excludes waterfowl covered by the North American Waterfowl Management Plan.

The Birds of Management Concern (BMC) is a 2011 document by FWS. The purpose of that document was to identify a "list of species, subspecies, populations or geographic segments of populations that warrant management or conservation attention, as identified by the U.S. Fish and Wildlife Service". To be of management concern they deemed a bird "must be a high priority gamebird, on the BCC, a federal threatened or endangered species, or overly abundant leading to management conflicts". Therefore, while this list includes waterfowl, it lists the majority of waterfowl species and populations that are actively managed by the Service.

Within the BMC is a Focal Species list. The purpose of that list was to identify "a subset of the Birds of Management Concern... the program believes need additional investment of resources to address pertinent conservation or management issues". While this list does a better job of narrowing the scope, the purpose was more to direct resources.

There are also various bird conservation plans (e.g., Partners in Flight North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan). Because the BCC used conservation assessment scores from these Plans, and many of these Plans have been updated since the BCC, we suggest the use of the BCC unless the underlying Conservation Plan is more up-to-date (which would be the case for the Landbird and Shorebird Plans). For waterfowl, I would suggest using the either the Focal Species list or the FWS Region 7 Priority Species list.

Shorebirds: U.S. Shorebirds of Conservation Concern. 2016. U.S. Shorebird Conservation Plan Partnership

Landbirds: Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. 2016. Partners in Flight Science Committee

Waterbirds: Birds of Conservation Concern. 2008. U.S. Fish and Wildlife Service

Waterfowl: Focal Species list *from* Birds of Management Concern. 2011. U.S. Fish and Wildlife Service

Commented [CRT1]: The Alaska Shorebird Conservation Plan is months away from final publication. The species ranking in that plan is finished and final and would be the most up-to-date and applicable for shorebirds. I can get a copy, but I am sure Rick has it at his fingertips.

Commented [CRT2]: I would ask Colleen Handel for the latest draft of the Alaska Songbird Plan. The current version online is 1999. I ve included the species below.

Fairly common species (as listed in Summary of Wildlife-Related Research on the Coastal Plain of the Arctic National Wildlife Refuge, Alaska, 2002–17) that are on these lists:

Shorebirds:

- Species of Greatest Conservation Concern
  - *None*
- Species of High Concern
  - American Golden-Plover
  - Dunlin (*arcticola)*
  - Buff-breasted Sandpiper
  - Pectoral Sandpiper
  - Semipalmated Sandpiper

Commented [CRT3]: This looks right to me, but there may be red knots in the foothills of the 1002 to the south. I am not sure anyone has ever been up there to look.

Landbirds:

- Red List
  - *None*
- Yellow List
  - Snowy owl
  - Gyrfalcon Snowy Owl Gray-cheeked Thrush Smith's Longspur

Commented [CRT4]: The last version of the Alaska landbird plan included these species. Gray-cheeked Thrush probably isn t very common if found at all on the 1002 coastal plain. If there are up-river impacts though, it would be considered along with Gray-headed Chickadee.

Waterbirds:

- BCC List for BCR 3
  - Red-throated loon
  - Yellow-billed loon
  - Arctic tern

Waterfowl:

- BMC Focal Species
  - Common eider (Pacific)
  - Black Brant (Pacific)
  - Greater Scaup
  - White-winged Scoter
- **Note – Sea Duck Joint Venture identified Long-tailed Duck as a High Priority Species in their 2014 Strategic Plan*

From: Daniel Ruthrauff
To: Richard Lanctot
Cc: Harwood, Christopher; Jim Johnson; River Gates; Robert E Gill; roy_churchwell@fws.gov; Christopher Latty
Subject: Re: ASCP
Date: Thursday, May 17, 2018 2:01:24 PM

Yeah, all our stuff derives from the 2016 list, and at least that way Roy is citing something that is published already. Works for me....

Dan Ruthrauff
Wildlife Biologist
US Geological Survey
Alaska Science Center
4210 University Drive
Anchorage, AK 99508
(907) 786-7162
druthrauff@usgs.gov

On Thu, May 17, 2018 at 9:24 AM Richard Lanctot <richard_lanctot@fws.gov> wrote:

> I recommended Chris use the 2016 us shorebird conservation plan partnership document to get priority shorebird shorebird species. It is mostly identical to the Alaska shorebird conservation plan. Cheers rick
>
> Sent from my iPhone
>
> On May 17, 2018, at 8:48 AM, Harwood, Christopher <christopher_harwood@fws.gov> wrote:
>
> > Roy Churchwell was interested this morning in using the BCR 3 species list to address an urgent data call (from BLM, I believe) about the 1002 area EIS. They're looking for the most recent list of species of conservation concern.
> >
> > Are we able to divulge that list, or similar lists or other parts of the plan, before the plan is finalized?
> >
> > I've got to think the BCR lists should be pretty final by now, while other parts may not be yet. However, I'm not sure how one cites such parts of the plan right now if they're indeed shared.
> >
> > I told Roy the plan will hopefully be finalized in the fall, and then pawned him off on Rick for his 1002-related question.
> >
> > CMH1
> >
> > --
> > Christopher Harwood
> > Wildlife Biologist
> > U.S. Fish and Wildlife Service
> > Kanuti National Wildlife Refuge

101 12th Ave.; Room 206
Fairbanks, AK 99701
(907) 455-1836 (w)
(907) 456-0506 (fax)

"In my house, anyone who uses one word when they could have used ten just isn't trying hard."

- Josiah Edward Bartlet, PhD, Nobel Laureate

From: Latty, Christopher
To: Churchwell, Roy
Subject: Fwd: Draft Seismic Exploration EA - Affected Environment
Date: Friday, May 18, 2018 6:45:01 AM

---------- Forwarded message ----------
From: **Joanna Fox** <joanna_fox@fws.gov>
Date: Wed, May 16, 2018 at 3:01 PM
Subject: Draft Seismic Exploration EA - Affected Environment
To: Stephen Arthur <stephen_arthur@fws.gov>, Christopher Latty <christopher_latty@fws.gov>, "Burkart, Greta" <greta_burkart@fws.gov>, Hollis Twitchell <hollis_twitchell@fws.gov>, Jennifer Reed <jennifer_reed@fws.gov>, Roger Kaye <Roger_Kaye@fws.gov>, Joshua Rose <joshua_rose@fws.gov>, "Swem, Ted" <ted_swem@fws.gov>, Erin Carver <erin_carver@fws.gov>, Patrick O'Dell <patrick_odell@fws.gov>, Edward Decleva <edward_decleva@fws.gov>, "Brown, Randy" <randy_j_brown@fws.gov>
Cc: Steve Berendzen <steve_berendzen@fws.gov>, Sarah Conn <sarah_conn@fws.gov>, Lynnda Kahn <lynnda_kahn@fws.gov>, Wendy Loya <wendy_loya@fws.gov>, stephanie_brady <stephanie_brady@fws.gov>

Good morning,

If you are receiving this message, you have either been identified as a lead member of the FWS Seismic Exploration Interdisciplinary Team, or as someone who has expertise that can assist in the development and review of the Environmental Assessment (EA) to analyze the impacts of seismic exploration in the Coastal Plain of the Arctic Refuge.

Specifically, BLM is tasking the FWS team with the responsibility for writing Chapter 3 of the EA (Existing Condition, or what we usually refer to as the Affected Environment). The current proposed timeline has us drafting this Chapter from May 16 (today) through May 25. We anticipate the timeline is going to get bumped back, but not significantly. Therefore, we believe it is imperative that we start our work on this project immediately.

To expedite and make this task as simple as possible, we propose we use the Draft Affected Environment chapter that was prepared last fall when we were tasked with changing the regulations for geological exploration of the 1002 area as a template. We are asking each of you to edit that document as you deem appropriate for this new proposed activity. Please edit and add comments to the Google Doc where you have subject matter expertise. We will consider this our working draft. Also - if you feel there are Affected Environment categories that are missing, please add them where you think appropriate (for example: it may be worth adding special designations like Wild & Scenic Rivers and Marine Protected Areas).

As you work, please keep in mind that under the new Department NEPA direction, complex EAs will be required to be less than 50 pages in length (appendices are not included in the total page numbers). For this task, you should include the level of detail you deem appropriate for the resource you have expertise about, recognizing that you will be tasked with providing a summary of that resource for the body of the EA.

Thanks much for your assistance with this project! If you have any questions or need additional clarification, please let me know.

Joanna

_____

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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"Do what you can, with what you have, where you are." -- Theodore Roosevelt

--

Christopher Latty
US Fish and Wildlife Service
Arctic NWR
101 12th Avenue
Room 236
Fairbanks, AK 99701
cell 907-347-4300

From: Joanna Fox
To: Roy Churchwell
Subject: Coastal Plain Photo Request
Date: Friday, May 18, 2018 10:51:15 AM

Hi Roy,

Could you go through the images in the following folders on our Photos drive and submit the best ones (with captions) to me via the following Google Form? I want to make sure BLM receives some of our more recent high quality images for use on their website and in outreach materials associated with the leasing EIS and seismic EA.

P:\Arctic\temporary storage\2009 season
P:\Arctic\temporary storage\2012 Canning shorebird nesting\Landscape_Plants
P:\Arctic\temporary storage\2012 Canning shorebird nesting\Wildlife
P:\Arctic\temporary storage\2012 ELIN PIERCE PHOTOS Canning

If you are aware of nice photos in other folders and can appropriately caption them, please feel free to submit those as well. It will be very helpful for us to have a nice collection for public use, media requests, and partners.

Arctic Refuge Coastal Plain Images

Thanks much!
Joanna

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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"Do what you can, with what you have, where you are." -- Theodore Roosevelt

From: Latty, Christopher
To: Churchwell, Roy
Subject: Re: Draft Seismic Exploration EA - Affected Environment
Date: Monday, May 21, 2018 2:26:31 AM

OK- I got nothing done on this over the weekend as personnel stuff took up the little time Ive had to do work stuff while on vacation. so what I sent you Friday is still the latest. If you can send me what you get done tomorrow I'll circulate it a bit broader.

Thanks much!!!!!!!!!!

On Fri, May 18, 2018 at 4:44 AM, Latty, Christopher <christopher_latty@fws.gov> wrote:

> ---------- Forwarded message ----------
> From: **Joanna Fox** <joanna_fox@fws.gov>
> Date: Wed, May 16, 2018 at 3:01 PM
> Subject: Draft Seismic Exploration EA - Affected Environment
> To: Stephen Arthur <stephen_arthur@fws.gov>, Christopher Latty <christopher_latty@fws.gov>, "Burkart, Greta" <greta_burkart@fws.gov>, Hollis Twitchell <hollis_twitchell@fws.gov>, Jennifer Reed <jennifer_reed@fws.gov>, Roger Kaye <Roger_Kaye@fws.gov>, Joshua Rose <joshua_rose@fws.gov>, "Swem, Ted" <ted_swem@fws.gov>, Erin Carver <erin_carver@fws.gov>, Patrick O'Dell <patrick_odell@fws.gov>, Edward Decleva <edward_decleva@fws.gov>, "Brown, Randy" <randy_j_brown@fws.gov>
> Cc: Steve Berendzen <steve_berendzen@fws.gov>, Sarah Conn <sarah_conn@fws.gov>, Lynnda Kahn <lynnda_kahn@fws.gov>, Wendy Loya <wendy_loya@fws.gov>, stephanie_brady <stephanie_brady@fws.gov>
>
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>
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Thanks much for your assistance with this project! If you have any questions or need additional clarification, please let me know.

Joanna

_____
Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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--
Christopher Latty
US Fish and Wildlife Service
Arctic NWR
101 12th Avenue
Room 236
Fairbanks, AK 99701
cell 907-347-4300

--
Christopher Latty
US Fish and Wildlife Service
Arctic NWR
101 12th Avenue
Room 236
Fairbanks, AK 99701
cell 907-347-4300

From:	Joanna Fox
To:	Stephen Arthur; Christopher Latty; Roy Churchwell; Burkart, Greta; Joshua Rose; Roger Kaye; Jennifer Reed; Alfredo Soto; Hollis Twitchell
Cc:	Steve Berendzen
Subject:	Fwd: Request for Scoping Comments from FWS Staff for the Arctic Refuge Coastal Plain Leasing EIS
Date:	Monday, May 21, 2018 12:55:55 PM

As we discussed during this morning's staff meeting, our scoping comments on the leasing EIS must be completed by June 1. This will give us time to review and edit them before Wendy compiles and submits them to the Regional Director for signature in mid-June. Please, if you haven't already looked through the Google doc, do so now and submit any comments, concerns or issues that you believe will influence the scope of the EIS and guide its development.

Thank you!
Joanna

_____
Joanna L. Fox
Deputy Refuge Manager
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(907) 456-0549

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---------- Forwarded message ---------
From: Wendy Loya <Wendy_loya@fws.gov>
Date: Thu, May 10, 2018 at 1:28 PM
Subject: Request for Scoping Comments from FWS Staff for the Arctic Refuge Coastal Plain Leasing EIS
To: Alfredo Soto <alfredo_soto@fws.gov>, Angela Matz <angela_matz@fws.gov>, Carl Johnson <carl_johnson@fws.gov>, Catherine Collins <catherine_collins@fws.gov>, Charles Hamilton <charles_hamilton@fws.gov>, Christopher Latty <christopher_latty@fws.gov>, Christopher Putnam <christopher_putnam@fws.gov>, Drew Crane <drew_crane@fws.gov>, Edward Decleva <edward_decleva@fws.gov>, Eric Taylor <eric_taylor@fws.gov>, Gilbert Castellanos <gilbert_castellanos@fws.gov>, Greta Burkart <greta_burkart@fws.gov>, Hollis Twitchell <hollis_twitchell@fws.gov>, Jennifer Reed <jennifer_reed@fws.gov>, Joanna Fox <joanna_fox@fws.gov>, John Martin <john_w_martin@fws.gov>, John Trawicki <john_trawicki@fws.gov>, Joshua Ream <joshua_ream@fws.gov>, Joshua Rose <joshua_rose@fws.gov>, Louise Smith <louise_smith@fws.gov>, Lynnda Kahn <lynnda_kahn@fws.gov>, Patrick O'Dell <patrick_odell@fws.gov>, Paul Leonard <paul_leonard@fws.gov>, Peter Butteri <peter_butteri@fws.gov>, Randy Brown <randy_j_brown@fws.gov>, Richard Lanctot <richard_lanctot@fws.gov>, Roger Kaye <roger_kaye@fws.gov>, Ryan Wilson <ryan_r_wilson@fws.gov>, Stephanie Brady <stephanie_brady@fws.gov>, Stephen Arthur <stephen_arthur@fws.gov>, Steve Berendzen <steve_berendzen@fws.gov>, Susan LaKomski <susan_lakomski@fws.gov>, Ted Swem <ted_swem@fws.gov>, Tim Allen <tim_allen@fws.gov>, Tracy Fischbach <tracy_fischbach@fws.gov>

Cc: Greg Siekaniec <greg_siekaniec@fws.gov>, Karen Clark <karen_clark@fws.gov>, Mitch Ellis <mitch_ellis@fws.gov>, Mary Colligan <mary_colligan@fws.gov>, Doug Damberg <doug_damberg@fws.gov>

Dear colleagues,

Thank you to those of you that were able to participate in the BLM Scoping meeting for Cooperating Agencies on May 3rd, and for sharing your expertise with the EIS Project Manager (Nicole Hayes) and contractor (EMPSi) and sub-contractors (ABR, Steven R Braund & Assoc, Northern Economics, ABR, HDR and DOWL).

Although the contractor took notes, including detailed notes on a laptop and more generalized notes on flip charts, the FWS has decided to submit written scoping comments. We invite you to submit concise, substantive comments on issues within or related to your area of expertise that should be considered for evaluation in the EIS. We especially want to highlight the most pressing issues and unique nature of the Arctic Refuge that should be described and evaluated. See the google doc for more info.

Please enter your comments in the following Google Doc (please do not delete others' comments):
https://docs.google.com/document/d/1sZhCAKBC7m0E6HUF_60kSCVJY7xn6lANn1hwZUxW-y4/edit#heading=h.gjdgxs

Please have your comments entered by June 1. Let your division point of contact know ASAP if that date is unattainable and we'll try to make alternative plans for receiving your comments. The program points of contact will review entries for duplication or clarity and submit to the Regional Director for signature and submission by the June 19th scoping deadline.

For your information the Service provided the BLM and EMPSi a PDF binder of the Resource Assessments and Select FWS Bibliography, which you can access here:
https://drive.google.com/file/d/1_124q-WQ6QnPehIZa84yENIxM4UPnzp-/view?usp=sharing

(Document available beginning on p.2)

Again, thank you all!

Wendy (Regional POC)

Steve & Joanna (Arctic Refuge)

John Trawicki (NWRS)

Drew Crane (FES)

Carl Johnson (OSM)

Eric Taylor (MBM)

Dr. Wendy M. Loya, Coordinator

Office of Science Applications -Arctic Program

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

From: Churchwell, Roy
To: Christopher Latty
Subject: EA affected environment
Date: Wednesday, May 23, 2018 11:09:16 AM
Attachments: First Draft affected environment.docx (Withheld b5-dp)

Hello Chris,

Here is a first draft. I am sure it will need a lot of work, but hopefully this start will get you most of the way there. I have a few comments in the margins of things that I don't know about, or changes I didn't want to make because I wasn't sure you would agree with them.

Roy

--
Roy Churchwell, PhD
Wildlife Biologist
US Fish and Wildlife Service
Kanuti National Wildlife Refuge
101 12th Ave. Room 206
Fairbanks, AK 99701
(907) 456-0450
https://www.fws.gov/refuge/kanuti/

From:	Joanna Fox
To:	Stephen Arthur; Christopher Latty; Roy Churchwell; Burkart, Greta; Jennifer Reed; Roger Kaye; Joshua Rose; Alfredo Soto; Hollis Twitchell
Cc:	Steve Berendzen
Subject:	Fwd: QRP/SSP
Date:	Thursday, May 24, 2018 11:18:55 AM

Please take a careful look at the studies that were proposed as part of the resource assessments exercise and consider submitting proposals for funding for those that are a high priority and meet the criteria (must have a willing and interested USGS partner, and contribute to making informed decisions that are relevant to oil and gas exploration and development on the coastal plain). You can also submit proposals for projects that weren't included in the resource assessments but would help us make good management decisions, This is a good opportunity to gain some additional information that will be very helpful moving forward!

Thanks much,
Joanna

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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---------- Forwarded message ---------
From: Trawicki, John <john_trawicki@fws.gov>
Date: Wed, May 23, 2018 at 3:54 PM
Subject: QRP/SSP
To:
Cc: Steve Berendzen <steve_berendzen@fws.gov>, Joanna Fox <joanna_fox@fws.gov>, Socheata Lor <socheata_lor@fws.gov>, Eric Taylor <eric_taylor@fws.gov>, Richard Lanctot <richard_lanctot@fws.gov>, Carl Johnson <carl_johnson@fws.gov>, Tracy Fischbach <tracy_fischbach@fws.gov>, John Trawicki <john_trawicki@fws.gov>, John Martin <john_w_martin@fws.gov>, Greta Burkart <greta_burkart@fws.gov>, Joshua Rose <joshua_rose@fws.gov>, Paul Leonard <paul_leonard@fws.gov>, Randy Brown <randy_j_brown@fws.gov>, Hollis Twitchell <hollis_twitchell@fws.gov>, Edward Decleva <edward_decleva@fws.gov>, Stephen Arthur <stephen_arthur@fws.gov>, Christopher Latty <christopher_latty@fws.gov>, Ryan Wilson <ryan_r_wilson@fws.gov>, Christopher Putnam <christopher_putnam@fws.gov>, Peter Butteri <peter_butteri@fws.gov>, Ted Swem <ted_swem@fws.gov>, Louise Smith <louise_smith@fws.gov>, Jennifer Reed <jennifer_reed@fws.gov>, Alfredo Soto <alfredo_soto@fws.gov>, Roger Kaye <roger_kaye@fws.gov>, Patrick O'Dell <patrick_odell@fws.gov>, Tim Allen <tim_allen@fws.gov>, Catherine Collins <catherine_collins@fws.gov>, Jill Webster <jill_webster@fws.gov>, Angela Matz <Angela_Matz@fws.gov>, Drew Crane

<drew_crane@fws.gov>

Hi All-

Drew Crane, Eric Taylor, and I (POCs) have been tasked with coordinating and helping to identify studies that would be good candidates for QRP/SSP funding.

The RDT decided to focus the funding from the USGS QRP/SSP program on science needs for the Arctic Refuge Coastal Plain (1002 Area) for the 2019 request.

There is $337,746 available in 2019, so we are likely looking at ~1-3 projects to put forward, although projects can continue past 2019 and receive additional funds in 2020 and 2021.

You are receiving this email because of your subject matter expertise for resources on the coastal plain of the Arctic Refuge and you were the principle author on the Resource Assessments completed in Feb. The Resource Assessment identified several information gaps and identified studies to address those gaps. Additional data/informational gaps may have come to light since the assessment were written-expected.

A link to a PDF that combines the 1002 Area Rapid-Response Resource Assessments and FWS Select Bibliography can be found at this link:
https://drive.google.com/file/d/1_124q-WQ6QnPehIZa84yENIxM4UPnzp-/view?usp=sharing
(Document available beginning on p.2)
or you can find it in the R7 Common Drive>Working>Resource Assessments_Originals.

The project must have a USGS partner, and contribute to making informed decisions on the coastal plain.

Please review your assessments, identify projects you are interested in submitting for funding and notify your POC. A short description will be required in early June. The steps and time-frames are:

Timeline (proposed):
May 15 - 31: Project review and id by Leads working with staff
Jun 1 - 22: Pre-proposal development for best fit project(s)
Jun 25 - Jul 9: RDT review and select
Jul 9 - Aug 30: Full proposal development
Aug 31: Proposals submitted to USGS

Thank you

john t

--
John Trawicki
Water Resources Branch Chief
National Wildlife Refuge System, Alaska
U.S. Fish and Wildlife Service

1011 E. Tudor Road
Anchorage, AK 99503
Work: (907) 786-3474
Mobile: (907) 360-1656

"The single biggest problem with communication is the illusion that it has taken place"
George Bernard Shaw

From:	Joanna Fox
To:	Stephen Arthur; Christopher Latty; Burkart, Greta; Hollis Twitchell; Jennifer Reed; Roger Kaye; Joshua Rose; Swem, Ted; Erin Carver; Patrick O"Dell; Edward Decleva; Brown, Randy
Cc:	Steve Berendzen; Sarah Conn; Lynnda Kahn; Wendy Loya; stephanie_brady
Subject:	Re: Draft Seismic Exploration EA - Affected Environment
Date:	Thursday, May 24, 2018 2:05:35 PM

We've learned that the new projected (still not final) timeline has moved the deadline for completing the draft Affected Environment chapter back to Friday, June 1. I know many of you have already made significant progress on your sections, so I'm optimistic we're going to be in a pretty good place. It's my understanding we're still going to receive some more "official" guidance from BLM, but I wanted to get this information out to you in the event we don't get that yet this week.

Please feel free to give me a call if you have any questions.

Thank you,
Joanna

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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On Wed, May 16, 2018 at 3:01 PM Joanna Fox <joanna_fox@fws.gov> wrote:

> Good morning,
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> If you are receiving this message, you have either been identified as a lead member of the FWS Seismic Exploration Interdisciplinary Team, or as someone who has expertise that can assist in the development and review of the Environmental Assessment (EA) to analyze the impacts of seismic exploration in the Coastal Plain of the Arctic Refuge.
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Joanna

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Fairbanks, AK 99701
(907) 456-0549

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From:	Wendy Loya
To:	Alfredo Soto; Angela Matz; Carl Johnson; Catherine Collins; Charles Hamilton; Christopher Latty; Christopher Putnam; Drew Crane; Edward Decleva; Eric Taylor; Gilbert Castellanos; Greta Burkart; Hollis Twitchell; Jennifer Reed; Joanna Fox; John Martin; John Trawicki; Joshua Ream; Joshua Rose; Louise Smith; Lynnda Kahn; Patrick O"Dell; Paul Leonard; Peter Butteri; Randy Brown; Richard Lanctot; Roger Kaye; Ryan Wilson; Stephanie Brady; Stephen Arthur; Steve Berendzen; Susan LaKomski; Ted Swem; Tim Allen; Tracy Fischbach
Subject:	Re: Request for Scoping Comments from FWS Staff for the Arctic Refuge Coastal Plain Leasing EIS
Date:	Friday, May 25, 2018 12:21:09 PM

Hi Everyone,

Just a reminder that June 1st, which is next Friday, is the deadline for entering your comments into the Google Docs form. Thank you to those of you that have already done so!

See original email below for more info.

Thank you all, and I hope everyone has a great Memorial Day weekend.

Wendy

Dr. Wendy M. Loya, Coordinator
Office of Science Applications -Arctic Program
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

On Thu, May 10, 2018 at 1:28 PM Wendy Loya <Wendy_loya@fws.gov> wrote:

> Dear colleagues,
>
> Thank you to those of you that were able to participate in the BLM Scoping meeting for Cooperating Agencies on May 3rd, and for sharing your expertise with the EIS Project Manager (Nicole Hayes) and contractor (EMPSi) and sub-contractors (ABR, Steven R Braund & Assoc, Northern Economics, ABR, HDR and DOWL).
>
> Although the contractor took notes, including detailed notes on a laptop and more generalized notes on flip charts, the FWS has decided to submit written scoping comments. We invite you to submit concise, substantive comments on issues within or related to your area of expertise that should be considered for evaluation in the EIS. We especially want to highlight the most pressing issues and unique nature of the Arctic Refuge that should be described and evaluated. See the google doc for more info.
>
> Please enter your comments in the following Google Doc (please do not delete others' comments):
> https://docs.google.com/document/d/1sZhCAKBC7m0E6HUF_60kSCVJY7xn6lANn1hwZUxW-y4/edit#heading=h.gjdgxs
>
> **Please have your comments entered by June 1.** Let your division point of contact know ASAP if that date is unattainable and we'll try to make alternative plans for receiving your comments. The program points of contact will review entries for duplication or clarity and submit to the Regional Director for signature and submission by the June 19th scoping deadline.

For your information the Service provided the BLM and EMPSi a PDF binder of the Resource Assessments and Select FWS Bibliography, which you can access here:
https://drive.google.com/file/d/1_124q-WQ6QnPehIZa84yENIxM4UPnzp-/view?usp=sharing

(Document available beginning on p.2)

Again, thank you all!

Wendy (Regional POC)
Steve & Joanna (Arctic Refuge)
John Trawicki (NWRS)
Drew Crane (FES)
Carl Johnson (OSM)
Eric Taylor (MBM)

Dr. Wendy M. Loya, Coordinator
Office of Science Applications -Arctic Program
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

From:	Wendy_loya@fws.gov
To:	Stephen Arthur; Joanna Fox; Steve Berendzen; John Trawicki; Drew Crane; Paul Leonard; Greta Burkart; Joshua Rose; Edward Decleva; Patrick O"Dell; Lynnda Kahn; Randy Brown; Christopher Latty; Eric Taylor; Richard Lanctot; Ryan Wilson (ryan_r_wilson@fws.gov); Hollis Twitchell; Carl Johnson; Joshua Ream; Roger Kaye; Jennifer Reed; John Martin; Angela Matz; Tim Allen; Catherine Collins; Mitch Ellis; Doug Damberg; Socheata Lor
Subject:	FWS Workshop on Alternatives for Coastal Plain Leasing EIS/Seismic EA

To prepare for the BLM's Arctic Refuge Coastal Plain Oil Leasing EIS Alternatives Workshop in July, we are holding an internal meeting June 19-20th in Fairbanks. The purpose of this meeting is to identify stipulations, best management practices and other leasing conditions to be applied to specific places that will help us achieve all of the purposes of the Arctic Refuge, from conservation of fish, wildlife, subsistence and water resources to the new purpose of an oil and gas program.

The workshop will be held in Fairbanks, and we hope to have as many people attend in person as possible for engaging, well-informed discussion across disciplines. The draft agenda is outlined below. We will set up a teleconference line for those that cannot make it to Fairbanks.

I will send out more information by subject matter group next week to help us come prepared with the data and existing regulations to support the need for stipulations similar to those found in NPRA. Paul Leonard is coordinating the compilation of spatial and temporal information on species habitat use and locations of special and unique landscape features.

DRAFT Agenda:
Arctic Refuge Coastal Plain Leasing EIS Alternatives Workshop
Tuesday June 19th
1 Welcome and Purpose 8:30-8:45
2 Intro to NPRA Alternatives & Stipulations 8:45-9:30
3 Vegetation/soils/permafrost/snow 9:30-10:00
break
4 Fish and Water resources 10:15-11:15
5 Caribou 11:15-11:45
Lunch & informal discussions 11:45-1:00
6 Polar bears/bears 1:00-2:00
7 Migratory birds 2:00-3:00
Break
8 Other mammals/all species 3:15-4:15
Meet for group dinner (optional) 5:30 pm

Wednesday June 20th
9 Wilderness/Recreation/Hunting 8:30-9:30
10 Unique features/WSR/Marine PA 930-1030
break 1030-1045
11 Cultural/Archaeological 10:45-11:45
Lunch & informal discussions 11:45-1:00
Subsistence 1:00-2:00
Operations not already covered 2:00-3:00
Wrap up/action items /adjourn 3:00-3:30
POC meet on next steps 3:30-5:00

Thank you,
Wendy

Dr. Wendy M. Loya, Coordinator
Office of Science Applications -Arctic Program
US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

From: Patton, Eva
To: Berendzen, Steve
Cc: Hollis Twitchell; Joanna Fox; Arthur, Stephen; Wendy Loya; Carl Johnson; Joshua Ream
Subject: Re: North Slope RAC to hold follow up teleconference June 8 - BLM NPR-A and 1002 updates
Date: Friday, May 25, 2018 7:21:13 PM

Thanks Steve

We'll be in touch for the fall North Slope RAC meeting, likely the Council and Chair will be interested in further updates at that time.

Thanks again

all the best

Eva

On Fri, May 25, 2018 at 3:44 PM, Berendzen, Steve <steve_berendzen@fws.gov> wrote:

> Thanks, Eva - Gordon is correct in saying that there should be adequate opportunity for people to participate and comment in the Scoping meetings.
>
> We appreciate the heads up :)
>
> Steve Berendzen
> Refuge Manager, Arctic National Wildlife Refuge
> 907-456-0253
>
> On Thu, May 24, 2018 at 3:17 PM, Patton, Eva <eva_patton@fws.gov> wrote:
>
> > Hi all,
> >
> > I wanted to follow up with you on the "follow up" North Slope RAC meeting. I just talked with Council Chair Gordon Brower this afternoon and he expressed to keep the meeting simple to focus on the BLM NPR-A information and disussion from the Winter meeting that they wanted to further address but not get into the 1002 scoping since there are ample public scoping meetings in the region that will be occurring around that time that Council members have an opportunity to participate in if they wish.
> >
> > Gordon did want to share for everyone's awareness that their was a big North Slope Borough meeting already scheduled to be held in Anchorage on June 12th - the new Kaktovik public scoping meeting date selected and that some of the Kaktovik leadership had already planned to be in Anchorage on that date. Hard to find meeting dates that work for all I know! We've been trying to get to this follow up RAC meeting for some time now.
> >
> > Do let me know if you have any questions.
> >
> > Thanks again
> >
> > Eva

On Wed, May 23, 2018 at 10:51 AM, Patton, Eva <eva_patton@fws.gov> wrote:

> Hi Steve,
>
> I talked with Hollis and Wendy and wanted to let you know we have been trying to schedule a follow up teleconference for the North Slope RAC for further updates and discussion on BLM NPR-A developments requested at their winter 2018 meeting. The meeting had gotten pushed back due to other public hearing and meetings for Special Action requests that took precedence on a tight timeline so we finally were able to set June 8th for the North Slope RAc follow up teleconference and this ends up within the Scoping public comment period for the 1002 area.
>
> BLM staff were key to providing information for the Council at this follow up meeting and are scheduled to present information and updates on both NPR-A and the 1002 area but still want to make sure Arctic National Wildlife Refuge staff have an opportunity to participate as questions may arise specific to the Refuge and the Porcupine Caribou Herd.
>
> Realize now that this meeting got pushed back into June that we are well into the field season and many people are quite busy or out of the office. Do let me know if I can be of any assistance for the Refuge participation in this meeting if that is an option.
>
> The two week public notice official News Release for the meeting is expected to go out this Thursday or Friday.
>
> Thank you
>
> Eva
>
> --
> Eva Patton
> Subsistence Council Coordinator
>
> U.S. Fish & Wildlife Service
> Office of Subsistence Management
> 1011 East Tudor Road, MS 121
> Anchorage, AK 99503-6199
> Tel: (907) 786-3358 Fax: (907) 786-3898
> 1-800-478-1456
> email:eva_patton@fws.gov

--
Eva Patton
Subsistence Council Coordinator

U.S. Fish & Wildlife Service
Office of Subsistence Management
1011 East Tudor Road, MS 121
Anchorage, AK 99503-6199

> Tel: (907) 786-3358 Fax: (907) 786-3898
> 1-800-478-1456
> email:eva_patton@fws.gov

--
Eva Patton
Subsistence Council Coordinator

U.S. Fish & Wildlife Service
Office of Subsistence Management
1011 East Tudor Road, MS 121
Anchorage, AK 99503-6199
Tel: (907) 786-3358 Fax: (907) 786-3898
1-800-478-1456
email:eva_patton@fws.gov

From: Tovar, Art
To: Berendzen, Steve
Cc: Doug Damberg; Joanna Fox; Hollis Twitchell; Paul Banyas
Subject: Re: $50M Construction Legacy List: Arctic National Wildlife Refuge, 1002 Area Oil Exploration Readiness
Date: Friday, May 25, 2018 9:47:24 PM

Steve, I will be calling in to the meeting as I am not in the office. Tks!!

Art Tovar
Facilities Program Manager
National Wildlife Refuge System Alaska
(907) 786-3348 Ofc
(907) 330-7509 Cell
art_tovar@fws.gov

On Fri, May 25, 2018 at 4:11 PM, Berendzen, Steve <steve_berendzen@fws.gov> wrote:

> Thanks, Art - I appreciate your efforts to get this clarified. I don't get into Anchorage until 8:55 next Wednesday, so we'll have to push our meeting back - maybe until after the Employee Recognition event?
>
> I'll also try to get some input from staff before Hollis and I come down there.
>
> Steve Berendzen
> Refuge Manager, Arctic National Wildlife Refuge
> 907-456-0253
>
> On Thu, May 24, 2018 at 4:08 AM, Art Tovar <art_tovar@fws.gov> wrote:
>
> > Steve, I made a typo on your name. Here you go.
> >
> > Art Tovar, Facilities Manager, Alaska Region, (907) 786-3348. Sent by iPhone.
> >
> > Begin forwarded message:
> >
> > **From:** Art Tovar <art_tovar@fws.gov>
> > **Date:** May 24, 2018 at 7:03:28 AM CDT
> > **To:** steve_berenzen@fws.gov
> > **Cc:** mitch_ellis@fws.gov, socheata_lor@fws.gov, doug_damberg@fws.gov, ronnie_sanchez@fws.gov, joanna_fox@fws.gov, david_morton@fws.gov
> > **Subject: Fwd: $50M Construction Legacy List: Arctic National Wildlife Refuge, 1002 Area Oil Exploration Readiness**
> >
> > Steve, here is some additional guidance that may help inform our meeting next week, Weds May 30th. As you and I discussed, maybe we could save money on the storage building in Kaktovik by using a MAT team and then use the balance on support facilities at either Galbraith or Arctic Village.
> >
> > Art Tovar, Facilities Manager, Alaska Region, (907) 786-3348. Sent by

iPhone.

Begin forwarded message:

From: Robert Miller <robert_miller@fws.gov>
Date: May 24, 2018 at 5:29:24 AM CDT
To: "Tovar, Art" <art_tovar@fws.gov>
Cc: Brad Long <brad_long@fws.gov>, Robert Williams <robert_l_williams@fws.gov>, "Lambert, Kirk" <kirk_lambert@fws.gov>
Subject: Re: $50M Construction Legacy List: Arctic National Wildlife Refuge, 1002 Area Oil Exploration Readiness

Art,

The funding is for:

Fueling Station $500K
Warehouse $2M
Support Infrastructure $1.5M

We left the support infrastructure vague because it was included when the hanger was still part of the project. I wanted to make sure we had enough for roads, utilities, parking, etc... Since the hanger wasn't approved, that leaves you with more latitude on how you use the $1.5. So, as long as you follow the narrative included with the approved project list (fairly broad sideboards intentionally), we will be fine. Ensure all the projects have a direct connection the 1002 area in the narrative, as we will have to provide more detailed project lists. We will also likely have to provide projected obligation dates, completion dates, progress reports and possibly more for these projects.

Thanks!

Rob Miller
Division of Facilities, Equipment & Transportation
US Fish and Wildlife Service

On May 23, 2018, at 9:54 PM, Tovar, Art <art_tovar@fws.gov> wrote:

> Rob, please do forward a summary email as you indicated in the e-mail string. Refuge leadership wants to make sure they understand the parameters. I.e. we have heard no hangar in Kaktovik, and Brad elaborated on that for me while down here at the

FMC conference that the hangar would be a no-go regardless of location. This is understandable and was always a long shot because of site limitations. The need is to somehow support flying operations at or near the 1002 area. At this point the refuge is looking to prioritize their needs but wants some additional working parameters. We will having a meeting on Weds, May 30th. I'm not sure they would want you on that call just yet until we all get on the same page as a Region. If you have more guidance now that would be helpful to frame our meeting. For example, without a hangar in Kaktovik, a secondary plan would be to fly in and out of either Galbraith Lake or Arctic Village (both have viable runways). This would require lodging at one or the other location (like what the Barter Island bunkhouse in Kaktovik would have provided). There is an existing cabin at Galbraith Lake that could be upgraded (or replaced) to accommodate this change and/or the leased cabin at Arctic Village could get replaced to accommodate flying operations. Each location would also need an outhouse. Would one or the other of these facilities be out of the question? In other words, based on the need to conduct flying operations in the 1002 area, can we triage priorities into something like I have just described, that still meets the intent of support infrastructure? The refuge has an open mind on this but does need to know the limits of acceptability. A fuel tank is still critical at Kaktovik as is a storage facility, however, the refuge does not want a big storage facility (less than 1,200 sf) because of sensitivity to local sentiment.

Please advise. Thanks!!

Art Tovar
Facilities Program Manager
National Wildlife Refuge System Alaska
(907) 786-3348 Ofc
(907) 330-7509 Cell
art_tovar@fws.gov

On Tue, May 22, 2018 at 12:30 PM, Lambert, Kirk <kirk_lambert@fws.gov> wrote:

> Brad,
>
> The description is in Rob's project descriptions for Construction Legacy Projects (attached).

Arctic National Wildlife Refuge, AK ($4,000,000): The nation's drive for energy dominance could hold its greatest promise in Alaska, where studies have shown that the Arctic National Wildlife Refuge's 1.2-million-acre coastal plain (the 1002 Area) may hold some 10 billion barrels of oil. As the Department of the Interior moves forward on environmental assessments, the U.S. Fish and Wildlife Service seeks to ensure that infrastructure will be ready to support oil exploration.

The Service will use the funds to build an aircraft fueling station, storage building and support infrastructure to ensure the 1002 Area is prepared for oil exploration. These facilities will be utilized by all DOI bureaus supporting the Administration's priorities in the 1002 Area, and are part of the Service's determination to be good neighbors by helping the Alaska State Police secure public safety for the tribal communities in and around Kaktovik.

Kirk Lambert, Facility Operations Specialist
Facilities & Equipment - Headquarters
National Wildlife Refuge System
U.S. Fish & Wildlife Service
911 NE 11th Ave, Portland, Oregon 97232
(503) 231-2078, FAX (503) 231-6161

Facility, Equipment, and Transportation User Guides: www.fws.gov/refuges/facilities/manuals-policies.html
FWS Constructed Real Property Policy: https://www.fws.gov/policy/372fw1.html
FWS Constructed Real Property Handbook: https://www.fws.gov/policy/ConRealPropHB.pdf
FBMS Real Property Business Process Guidance: https://inside.fws.gov/go/post/FBMS-BP_RP#RPofficial
FBMS Energy Reporting Business Process Guidance: https://inside.fws.gov/index.cfm/go/post/FBMS-BP_Energy
FBMS Accounts Payable Business Process Guidance (Reportable and Mixed Utilities): https://inside.fws.gov/go/post/FBMS-BP_AP

GSA Real Property Disposal Information and Report of

Excess Portal: https://disposal.gsa.gov/FAA

---------- Forwarded message ----------
From: **Lambert, Kirk** <kirk_lambert@fws.gov>
Date: Tue, May 22, 2018 at 1:26 PM
Subject: Re: $50M Construction Legacy List: Arctic National Wildlife Refuge, 1002 Area Oil Exploration Readiness
To: Robert Miller <robert_miller@fws.gov>

Thanks!

Kirk Lambert, Facility Operations Specialist
Facilities & Equipment - Headquarters
National Wildlife Refuge System
U.S. Fish & Wildlife Service
911 NE 11th Ave, Portland, Oregon 97232
(503) 231-2078, FAX (503) 231-6161

Facility, Equipment, and Transportation User Guides: www.fws.gov/refuges/facilities/manuals-policies.html
FWS Constructed Real Property Policy: https://www.fws.gov/policy/372fw1.html
FWS Constructed Real Property Handbook: https://www.fws.gov/policy/ConRealPropHB.pdf
FBMS Real Property Business Process Guidance: https://inside.fws.gov/go/post/FBMS-BP_RP#RPofficial
FBMS Energy Reporting Business Process Guidance: https://inside.fws.gov/index.cfm/go/post/FBMS-BP_Energy
FBMS Accounts Payable Business Process Guidance (Reportable and Mixed Utilities): https://inside.fws.gov/go/post/FBMS-BP_AP

GSA Real Property Disposal Information and Report of Excess Portal: https://disposal.gsa.gov/FAA

On Tue, May 22, 2018 at 1:23 PM, Robert Miller <robert_miller@fws.gov> wrote:

> Kirk,
>
> The projects include all the projects at Arctic that R7 and I discussed except the hanger. I'll

forward a summary email.

Thanks!

Rob Miller
Division of Facilities, Equipment & Transportation
US Fish and Wildlife Service

On May 22, 2018, at 4:15 PM, Lambert, Kirk <kirk_lambert@fws.gov> wrote:

> Rob or Marilyn,
>
> The Construction Legacy list for the $50M includes $4M for "1002 Area Oil Exploration Readiness" at Arctic NWR.
>
> There's no existing work order for the project in SAMMS. Region 7 needs to create one. They're meeting tomorrow morning and would like to know what the project includes. All I know is that it has something to do with oil exploration in the 1002 area, where the Department supports oil and gas leasing.
>
> Do you have more specifics that Region 7 can use to create a work order, write a project description and scoring narratives, and discuss the project?
>
> Kirk Lambert, Facility Operations Specialist
> Facilities & Equipment - Headquarters
> National Wildlife Refuge System
> U.S. Fish & Wildlife Service
> 911 NE 11th Ave, Portland, Oregon 97232
> (503) 231-2078, FAX (503) 231-6161
>
> Facility, Equipment, and Transportation User Guides: www.fws.gov/refuges/facilities/manuals-policies.html
> FWS Constructed Real Property Policy: https://www.fws.gov/po

licy/372fw1.html
FWS Constructed Real Property Handbook: https://www.fws.gov/policy/ConRealPropHB.pdf
FBMS Real Property Business Process Guidance: https://inside.fws.gov/go/post/FBMS-BP_RP#RPofficial
FBMS Energy Reporting Business Process Guidance: https://inside.fws.gov/index.cfm/go/post/FBMS-BP_Energy
FBMS Accounts Payable Business Process Guidance (Reportable and Mixed Utilities): https://inside.fws.gov/go/post/FBMS-BP_AP

GSA Real Property Disposal Information and Report of Excess Portal: https://disposal.gsa.gov/FAA

From: Joanna Fox
To: Wendy Loya
Cc: Drew Crane; Steve Berendzen
Subject: Re: Question about Alternatives for Seismic EA
Date: Tuesday, May 29, 2018 11:30:10 AM

Hi Wendy,

When we first spoke with Shelly Jones about the EA, b5 - dp [redacted] However, when we last spoke with her she told us she still wasn't sure that would ultimately be the case. So, for now we don't know. I'll let you know if we learn something different.

Thanks!
Joanna

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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www.facebook.com/arcticnationalwildliferefuge

"Do what you can, with what you have, where you are." -- Theodore Roosevelt

On Fri, May 25, 2018 at 1:27 PM Wendy Loya <Wendy_loya@fws.gov> wrote:

> HI Joanna,
>
> Can you see Drew's email below asking about alternatives for Seismic EA and reply all?
>
> The Alternatives workshop for the Leasing EIS should be at the right time to help inform the seismic stipulations needed for the Seismic EA so we are consistent in our requests across the two docs.
>
> Thanks,
>
> Wendy

Dr. Wendy M. Loya, Coordinator

Office of Science Applications -Arctic Program

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

From: Crane, Drew <drew_crane@fws.gov>
Sent: Friday, May 25, 2018 1:22 PM
To: Wendy Loya <Wendy_loya@fws.gov>
Subject: Re: Important note about Internal Alternatives Workshop invitation

Hey Wendy,

b5 - dp [redacted] Do you know if BLM is planning on adding another one in the mix?

Thanks

Drew

From:	Trawicki, John
To:	Joanna Fox; Eric Taylor; Richard Lanctot; Carl Johnson; Tracy Fischbach; John Trawicki; John Martin; Greta Burkart; Joshua Rose; Paul Leonard; Randy Brown; Hollis Twitchell; Edward Decleva; Stephen Arthur; Christopher Latty; Ryan Wilson; Christopher Putnam; Peter Butteri; Ted Swem; Louise Smith; Jennifer Reed; Alfredo Soto; Roger Kaye; Patrick O"Dell; Tim Allen; Catherine Collins; Jill Webster; Angela Matz; Drew Crane
Subject:	Fwd: Moving forward with requests for pre-proposals for USGS QRP/SSP
Date:	Tuesday, May 29, 2018 4:12:26 PM
Attachments:	FY2019_PreProposalTemplate_20180514.docx

Apologize for not having the forms attached last week, could not find the original email.

---------- Forwarded message ----------
From: **Wendy Loya** <Wendy_loya@fws.gov>
Date: Tue, May 15, 2018 at 10:51 AM
Subject: Moving forward with requests for pre-proposals for USGS QRP/SSP
To: Eric Taylor <eric_taylor@fws.gov>, Drew Crane <drew_crane@fws.gov>, John Trawicki <john_trawicki@fws.gov>

Hi Eric, Drew and John,

The region is now seeking proposals for the Quick Response Program (QRP) and Science Support Partnerships (SSP) for FY2019. These funds are made available annually by the U.S. Geological Survey (USGS) to address priority research needs identified by USFWS. SSP projects can extend over three years while QRP projects must be completed within 18 months and require no more than $50,000. In FY2019, a total of $337,746 will be available for projects that advance the best available science for the coastal plain of the Arctic National Wildlife Refuge (1002 area), particularly towards implementing responsible exploration and development of oil and gas resources. Proposed projects can extend beyond the Refuge Coastal Plain if appropriate to answering management questions.

You have been identified by your ARD (or yourself) as the lead for your division to work with your colleagues, including across divisions, to review the list of studies derived from the Resource Assessments (link) and the Resource Assessments themselves (link), and to identify which study or studies are a good fit for the QRP/SSP opportunity, including identifying a USGS research partner. Promising projects will then be described in a pre-proposal to be submitted to me, and I will forward these to the RDT for consideration and determining which should be developed into full proposals. Because of the rapid-response nature of the Resource Assessments, there may be additional research needs not on the list that may be proposed.

Naturally, Mig Birds should consider avian studies, and include Chris Latty in discussion; FES should consider at least Polar Bears and Fish; and Refuges should consider projects within the expertise of NWRS and Arctic Refuge staff. Please also consider talking with BLM Arctic Field Office staff with relevant expertise in identifying projects which are appropriate for FWS to conduct, by considering also which studies are typically done by industry to meet their

project or site specific needs. We'll work to include a biometrician and data-manager in the full proposal development.

Timeline (proposed):

May 15 – June 1: Project list review, select best fit(s) including possible USGS partner(s)

Jun 4 - 22: Pre-proposal development for best fit project(s)

Jun 25 - Jul 9: RDT review and select

Jul 9 - Aug 30: Full proposal development

Aug 31: Proposals submitted to USGS

I am sure you'll have questions, so don't hesitate to reach out to me and we can also try to have a 30 min group discussion if needed. I hope I am not overlooking any major details…?

Attached is the pre-proposal template. I'll send an invite for us to meet around June 4th to have a look at the suite of projects selected for pre-proposal development.

Thank you,

Wendy

Dr. Wendy M. Loya, Coordinator

Office of Science Applications -Arctic Program

US Fish and Wildlife Service

Anchorage, Alaska

907.786.3532 (office)

907.277.2942 (mobile)

--

John Trawicki
Water Resources Branch Chief
National Wildlife Refuge System, Alaska
U.S. Fish and Wildlife Service
1011 E. Tudor Road
Anchorage, AK 99503
Work: (907) 786-3474
Mobile: (907) 360-1656

"The single biggest problem with communication is the illusion that it has taken place"
George Bernard Shaw

FY 2019 QUICK RESPONSE PROGRAM (QRP) AND SCIENCE SUPPORT PARTNERSHIP (SSP)

PRE-PROPOSAL

The region is now seeking proposals for the Quick Response Program (QRP) and Science Support Partnerships (SSP) for FY2019. These funds are made available annually by the U.S. Geological Survey (USGS) to address priority research needs identified by USFWS. SSP projects can extend over three years while QRP projects must be completed within 18 months and require no more than $50,000. In FY2019, a total of $337,746 will be available for projects that advance the best available science for the coastal plain of the Arctic National Wildlife Refuge (1002 area), particularly towards implementing responsible exploration and development of oil and gas resources. Proposed projects can extend beyond the Refuge Coastal Plain if appropriate to answering management questions.

Division leads from Migratory Birds, Ecological Services and Refuges should work with their staff, and across divisions, to review the list of studies derived from the Resource Assessments (link) and identify which study or studies are a good fit for the QRP/SSP opportunity, including identifying a USGS research partner. Because of the rapid-response nature of the Resource Assessments, there may be additional research needs not on the list that may be proposed.

Project Title:

Management Question:

Project Duration:

Years	Months

FWS Lead *(name, title, program, email, phone)***:**

USGS Lead *(if known) (name, title, program, email, phone)***:**

Conservation outcome:

Project Objectives:
1.

Project Description:

Budget:

Total Budget *(use High column if project budget is not scalable)*:

High	Medium	Low

Comments on budget scale *(e.g., with $50K we could do X; with $100K we could do 2x)*:

Annual Budget *(use FY2019 for projects ≤18 months in duration)*:

FY2019	FY2020	FY2021	TOTAL

From: Joanna Fox
To: Hollis Twitchell; Roger Kaye; Joshua Rose; Christopher Latty; Stephen Arthur; Jennifer Reed
Subject: DRAFT Seismic EA - Please review ASAP
Date: Monday, June 4, 2018 10:00:54 AM

Good morning,

I am getting ready to share our DRAFT EA with key POCs in the Regional Office, who will be reviewing prior to moving through surname for submittal to BLM. Will each of you please review your sections one more time ASAP and confirm you have completed your work?

DRAFT Seismic EA - Chapter 3 Existing Condition (Withheld b5-dp) (Note: links to same doc on pages 283,331, 334, 343)

Thank you,
Joanna

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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www.facebook.com/arcticnationalwildliferefuge

"Do what you can, with what you have, where you are." -- Theodore Roosevelt

From: Joanna Fox
To: Hollis Twitchell
Subject: EA edits from FES
Date: Wednesday, June 6, 2018 2:21:33 PM
Attachments: DRAFT Seismic EA - Chapter 3 Existing Condition_SC.docx (Withheld b5-dp)

Sarah Conn spent yesterday editing the Affected Environment Chapter - but did so in a saved copy using track changes so she could send it to other FES folks. Recognizing we're now re-writing many of the sections, her comments may be of use to you - either to be incorporated into your revised EA summary text - or into the appendices/specialist reports.

Hope this helps!
Joanna

Joanna L. Fox
Deputy Refuge Manager
Arctic National Wildlife Refuge
101 12th Avenue, Room 236
Fairbanks, AK 99701
(907) 456-0549

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www.facebook.com/arcticnationalwildliferefuge

"Do what you can, with what you have, where you are." -- Theodore Roosevelt

F om wanda_hood@fws.gov
To
Subject Invita ion WS Wo kshop on Alte na ives fo Coastal la n ass ng El @ Tue 2018-06-19 08:30 - Wed 2018-06-20 16:00 (MDT) (ch is ophe _putnam@fws.gov)
Attachments

ase s dule a s s ch lps www.gang.e ssen ca enda vent?

[redacted]

ENG Wo kshop on A ta nat ves fo Coa ta P a n Lass ng E S he ons s EA
Tu y jan 8 - ba BEAR 1 A st t Re ngs Co nts P a t ST Le s ng EIS A ta nat ves We kshop a h y wo a s he d ng an o s na ons t ng ons 19 20th n Fo banks The s poses of h s m et ng s to deve y t pes at e c bet nnaag ment p act ces and e lo e s ng cond t ons to be upp ed to spec f c p ases hat w ke p m ach eves a of he pu poses of the A ct c Re ngs f om consu tat on eff ds w d fe ebo tun e nd tentic essm ents to he w pu pos e of an e nted ss p ng m

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I w ne d ust mo e s o mat ter by ship t mo to g esp ext w ek o he p ss cons p epa ed w h he data and an t ng ags t oos to supp t the need fo st pa at ones s m a e hose fo ed n NWRA Pen L ma d s ces d n t ng he emp at ons of qua a and emp e s nfo mat on on spec es hab ta s a d ct mat ons of spec a and en gan and sspe fica ons

DRAFT Agenda
A ct c Re ngs Con ts P a n Lass ng EIS A ta nat ves We shop
Tu sday June 19th

1
We ome and Pu pose
8 30 8 45

2
Int o n NPRA A a nat v s & Sc pa at ons
8 45 9 30

3
Vegi tat on ss s pe mad ent s ate
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B eak

4
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5
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Ma ne Mam ma d ssus s ns
11 45 1 00

6
Pu a bua s bus s
1 00 2 00

M g ato y Sh ds
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B eak

8
O ho mmenda s a spac es
3 15 4 15
Mari ne g mp d ssus sp t ons)
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Wa dsen ep ssus 2 ds

9
W ds & ss Rec ent on Hunt ng
8 30 9 30
10
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9 30 10 00
B eak
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Lan Ju & sfd ma d ssus s ns
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S bs tence
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Ca bou s ssed a ands serve ed
2 00 3 00
W ap ng ol ons t ns dpoi n
3 00 3 30
POC meet ons next steps
3 30 3 00

Th nk you
Wanda

D Wanda M Lopez Con d nat o
U S ecol Se vice Appr cat ons-A s t e P g ans
US F sh and W d fe Se v ce
Ana ska Reg on
907 786 3925 (o f c)
907 271 2842 (mob e)

When Tue 2018-06-19 08:30 - Wed 2018-6-20 16:00 A as a T me
Whe e Fa banks Re ngon Confe ence Room [redacted]
Who Ja ne ha hing ton geog ra ic hange [redacted]
C ended by Sophie _putnam@fws.g v
Who • wanda_ryan@ fws.gov - o g a n ze
• Roger_Kato v
• Ryan W ison (yan_ w ison@fws.gov)
• Ja ne Ha hing
• Kelsie A Dun ava
• ame s Rosel
• M ch & s
• R chie d Lane st
• Ja ne Ha hing
• L Sophie _putnam@fws.gov
• ssha Rosa
• S ova Ba ansk on
• P a L ma s
• Ka e Ma ga e s
• Lyd a A Bas
• Ca lie ne Co ns
• P T ch ON
• Su Sunta Lo
• Ma k Ma ck
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From:	Wendy Loya
To:	Paul Leonard; John Trawicki; Randy Brown; Doug Damberg; Jennifer Reed; Joanna Fox; Hollis Twitchell; Drew Crane; Lynnda Kahn; Angela Matz; Christopher Latty; Patrick O"Dell; Carl Johnson; Mitch Ellis; Stephen Arthur; Steve Berendzen; Joshua Ream; Eric Taylor; Catherine Collins; Socheata Lor; Roger Kaye; Edward Decleva; Tim Allen; Ryan Wilson; Joshua Rose; Christopher Putnam; Kevin Doherty; Todd Hopkins; Tracy Fischbach; Karen Clark; Greg Siekaniec; Bud Cribley; Agnew Beck; Sara Boario; Mary Colligan
Subject:	Agenda for FWS Workshop on Alternatives for Coastal Plain Leasing EIS/Seismic EA 6/19-20
Date:	Sunday, June 17, 2018 7:19:03 PM
Attachments:	Print Version Table 2.3_Stips_BMPs for FWS Workshop 061718a .xlsx AGENDA FWS Internal Alternatives Wkshp Coastal Plain Leasing EIS 061519.pdf

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Dear FWS "1002" team,

Attached is the agenda for the FWS Internal Alternatives Workshop for the Arctic Refuge Coastal Plain Leasing EIS. I am excited to have so many of our staff experts join us in Fairbanks; we will meet in the Refuges Conference room on the 2nd floor of the Fairbanks Field Office/Federal Building downtown. Greg Siekaniec will be opening the workshop at 8:30am on Tuesday, and we hope to be done by 4:30pm both days. We are happy to have Meghan Holtan from Agnew Beck as our facilitator.

The workshop will focus on the spatial component of developing alternatives for the Arctic Refuge Coastal Plain, including availability of lands for leasing and stipulations/best management practices (BMPs) that would protect sensitive resources. There are many BMPs that are used to protect resources that we won't have time to discuss as a group, but which we will solicit feedback on between June 21-July 6th, prior to the BLM Alternatives workshop. You can see all of the NPRA Stipulations and BMPs in the attached excel workbook which organizes the NPRA Final IAP/EIS Table 2.3 by the topics. I will have copies on hand at the workshop.

FYI, we will join the BLM/EMPSi-hosted "Coastal Plain Leasing EIS Affected Environment Kick-off" on Weds at 10am.

A few logistical notes:

Please take the elevator when you come in the North side main entrance and go to 2nd floor. You will get locked in stairwells unless your PIV card is active for the Fairbanks Field Office building.

A few who can't attend can connect via Vidyo and phone, see the agenda for connection info.

I have made a reservation for the group to go to dinner at Chena Pump House Tuesday evening at 6pm. We will have plenty of vehicles to shuttle those that don't have transportation.

If you have indicated you are not able to attend… don't fret, we'll continue to gather information and feedback until the BLM-hosted workshop on July 9th.

Thank you, and see you soon! Don't hesitate to contact me with any questions,
Wendy

Dr. Wendy M. Loya,
Arctic Program Coordinator
Office of Science Applications, US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

PREPARED FOR INTERNAL FWS STAFF USE

Created June 16, 2018 as PDF to text of Table 2.3 from NPRA IAP/FEIS (pages 42-111 in Volume 1)
https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=14702

Tabs by Resource Categories: Stips and BMPs that primarily apply to resource topics for NPRA Alternatives B1, B2, C and D. Most Stipulations and alternatives are the same across all Alternatives, but may be applied to more or less lease blocks.

Contact: Wendy Loya wendy_loya@fws.gov
Last edit date: 06/17/18

WATER USE FOR PERMITTED ACTIVITIES				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
B-1 Best Management Practice Objective: Maintain populations of, and adequate habitat for, fish and invertebrates. Requirement/Standard: Withdrawal of unfrozen water from rivers and streams during winter is prohibited. The removal of ice aggregate from grounded areas ≤4-feet deep may be authorized from rivers on a site- specific basis.				water
B-2 Best Management Practice Objective: Maintain natural hydrologic regimes in soils surrounding lakes and ponds, and maintain populations of, and adequate habitat for, fish, invertebrates, and waterfowl. Requirement/Standard: Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas ≤4-feet deep may be authorized on a site-specific basis depending on water volume and depth and the waterbody's fish community. Current water use requirements are: a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 15% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are≤7-feet deep. b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 30% of calculated volume deeper than 5 feet; only ice aggregate may be removed from lakes that are ::5. c. Lakes with no fish present, regardless of depth: water available for use is limited to 35% of total lake volume. d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 15%, 30%, or 35% volume calculations. e. Additional modeling or monitoring may be required to assess water level and water quality conditions before, during, and after water use from any fish-bearing lake or lake of special concern. f. Any water intake structures in fish bearing or non-fish bearing waters shall be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury. Note: All water withdrawal equipment must be equipped and must utilize fish screening devices approved by the Alaska Department of Fish and Game, Division of Habitat. g. Compaction of snow cover or snow removal from fish-bearing waterbodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes, or areas of grounded ice.				water
WINTER OVERLAND MOVES AND SEISMIC WORK				

C-3 Best Management Practice Objective: Maintain natural spring runoff patterns and fish passage, avoid flooding, prevent streambed sedimentation and scour, protect water quality and protect stream banks. Requirement/Standard: Crossing of waterway courses shall be made using a low-angle approach. Crossings that are reinforced with additional snow or ice ("bridges") shall be removed, breached, or slotted before spring breakup. Ramps and bridges shall be substantially free of soil and debris.				water
C-4 Best Management Practice Objective: Avoid additional freeze-down of deep-water pools harboring over-wintering fish and invertebrates used by fish. Requirement/Standard: Travel up and down streambeds is prohibited unless it can be demonstrated that there will be no additional impacts from such travel to over-wintering fish or the invertebrates they rely on. Rivers, streams, and lakes shall be crossed at areas of grounded ice whenever possible.				water
C-5 Best Management Practice **NOTE**: **This best management practice is only applicable to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: Minimize the effects of high-intensity acoustic energy from seismic surveys on fish. Requirement/Standard: a. When conducting vibroseis-based surveys above potential fish overwintering areas (water 6 feet deep or greater, ice plus liquid depth), operators shall follow recommendations by Morris and Winters (2005): only a single set of vibroseis shots should be conducted if possible; if multiple shot locations are required, these should be conducted with minimal delay; multiple days of vibroseis activity above the same overwintering area should be avoided if possible. b. When conducting air gun-based surveys in freshwater, operators shall follow standard marine mitigation measures that are applicable to fish (e.g., Minerals Management Service 2006): operators will use the lowest sound levels feasible to accomplish their data-collection needs; ramp-up techniques will be utilized (ramp-up involves the gradual increase in emitted sound levels beginning with firing a single air gun and gradually adding air guns until the desired operating level of the full array is obtained). c. When conducting explosive-based surveys, operators shall follow setback distances from fish-bearing waterbodies based on requirements outlined by Alaska Department of Fish and Game (1991).				fish
OIL AND GAS EXPLORATORY DRILLING				

D-1 Lease Stipulation Objectives: Protect fish-bearing rivers, streams, and lakes from blowouts and minimize alteration of riparian habitat. Requirement/Standard: Exploratory drilling is prohibited in rivers and streams, as determined by the active floodplain, and fish-bearing lakes.				fish
FACILITY DESIGN AND CONSTRUCTION				
E-2 Lease Stipulation Objective: Protect fish-bearing waterbodies, water quality, and aquatic habitats. Requirement/Standard: Permanent oil and gas facilities, including roads, airstrips, and pipelines, are prohibited upon or within 500 feet as measured from the ordinary high watermark of fish-bearing waterbodies. Essential pipeline and road crossings will be permitted on a case-by-case basis. **Note**: Also refer to Area-Specific Stipulations and Best Management Practices for Rivers Area (*Lease Stipulation K-1*) and Deep Water Lakes (*Lease Stipulation K-2*). Construction camps are prohibited on frozen lakes and river ice. Siting of construction camps on river sand and gravel bars is allowed and encouraged. Where leveling of trailers or modules is required and the surface has a vegetative mat, leveling shall be accomplished through blocking rather than use of a bulldozer.				water, fish
E-3 Lease Stipulation Objective: Maintain free passage of marine and anadromous fish and protect subsistence use and access to subsistence hunting and fishing. Requirement/Standard: Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas. Causeways, docks, artificial islands, and bottom-founded drilling structures shall be designed to ensure free passage of marine and anadromous fish and to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics. A monitoring program, developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies, shall be required to address the objectives of water quality and free passage of fish.				fish, subsistence

E-8 Best Management Practice Objective: Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources. Requirement/Standard: Gravel mine site design and reclamation will be in accordance with a plan approved by the authorized officer. The plan shall be developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies and consider: a. Locations outside the active floodplain. b. Design and construction of gravel mine sites within active floodplains to serve as water reservoirs for future use. c. Potential use of the site for enhancing fish and wildlife habitat. d. Potential storage and reuse of sod/overburden for the mine site or at other disturbed sites on the North Slope.	water, reclamation
E-14 Best Management Practice Objective: Ensure the passage of fish at stream crossings. Requirement/Standard: To ensure that crossings provide for fish passage, all proposed crossing designs shall adhere to the best management practices outlined in "Stream Crossing Design Procedure for Fish Streams on the North Slope Coastal Plain" by McDonald et al. (1994), "Fundamentals of Culvert Design for Passage of Weak-Swimming Fish" by Behlke et al. (1991), and other generally accepted best management procedures prescribed by the authorized officer. To adhere to these best management practices, at least 3 years of hydrologic and fish data shall be collected by the lessee for any proposed crossing of a stream whose structure is designed to occur, wholly or partially, below the stream's ordinary high watermark. These data shall include, but are not limited to, the range of water levels (highest and lowest) at the location of the planned crossing, and the seasonal distribution and composition of fish populations using the stream.	water, fish
ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS	

K-1 Lease Stipulation/Best Management Practice – Rivers **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternatives, K-1 would be a best management practice. In Alternatives B-1 and B-2, portions of the Colville, Ikpikpuk, Kikiakrorak, Kogosukruk, and Titalik rivers have larger setbacks than in the other alternatives; see below for the details. Objective: Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin and campsites; the disruption of subsistence activities; and impacts to scenic and other resource values. Requirement/Standard: Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the streambed and adjacent to the rivers listed below at the distances identified. (Gravel mines may be located within the active floodplain consistent with Best Management Practice E-8). On a case-by case basis, and in consultation with federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility), essential pipeline and road crossings to the main channel will be permitted through setback areas. The above setbacks may not be practical within river deltas. In these situations, permanent facilities shall be designed to withstand a 200-year flood event. In the below list, if no upper limit for the setback is indicated, the setback extends to the head of the stream as identified in the National Hydrography Dataset. a. Colville River: a 1-mile setback (2-mile setback in Alternatives B-1 and B-2) from the boundary of NPR-A where the river determines the boundary along the Colville River as determined by cadastral survey to be the highest high watermark on the left (western or northern) bank and from both banks' ordinary high watermark where BLM-manages both sides of the river up through T5S, R30W, U.M. Above that point to its source at the juncture of Thunder and Storm creeks the setback will be 0.5 mile. Note: The planning area excludes conveyed Native lands along the lower reaches of the Colville River. Development of road crossings intended to support oil and gas activities shall be consolidated with other similar projects and uses to the maximum extent possible. Note: This provision does not apply to intercommunity or other permanent roads constructed with public funds for general transportation purposes, though the BLM would encourage minimal use of the setback area. This preserves the opportunity to plan, design, and construct public transportation systems to meet the economic, transportation, and public health and safety needs of the State of Alaska and/or communities within National Petroleum Reserve-Alaska.	water

Continued....K-1 Lease Stipulation/Best Management Practice – Rivers b. Ikpikpuk River: a 0.5-mile setback from of the ordinary high watermark of the Ikpikpuk River extending from the mouth south to section 19, T7N, R11W, U.M. From section 19, T7N, R11W, U.M., to section 4, T3N, R12W, U.M., a 1-mile setback is required. Beginning at section. 4, T3N, R12W, U.M., a 0.5-mile setback from the centerline (1 mile total) will be required to the confluence of the Kigalik River and Maybe Creek. In Alternative B-1 and B-2, the setback would be 2 miles from the ordinary high watermark from the mouth of the river upstream through T7 N, R11W, U.M.; above that point the setback would be the same as described above in Alternative B-1 and 1 mile in Alternative B-2. c. Miguakiak River: a 0.5-mile setback from the bank's ordinary high watermark. d. Kikiakrorak and Kogosukruk Rivers: A 1-mile setback from the top of the bluff (or ordinary high watermark if there is no bluff) on the Kikiakrorak River downstream from T2N., R4W, U.M. and on the Kogosukruk River (including Branch of Kogosukruk River, Henry Creek, and two unnamed tributaries off the southern bank) downstream from T2N, R3W, U.M. In Alternatives B-1 and B-2, the setback would be 2 miles from the top of the bluff (or bank if there is no bluff) for the same waterbodies. The setback from these streams in Alternatives B-1 through D in the named townships and further upstream as applicable will be 0.5 mile from the top of the bluff or bank if there is no bluff. e. Fish Creek: a 3-mile setback from the bank's highest high watermark of the creek downstream from the eastern edge of section 31, T11N, R1E., U.M. and a 0.5-mile setback from the bank's highest high watermark farther upstream. f. Judy Creek: a 0.5-mile setback from the banks' ordinary high watermark. g. Ublutuoch (TiJJmiaqsiugvik) River: a 0.5-mile setback from the ordinary high water mark. h. Alaktak River: a 0.5-mile (1 mile for Alternative B-2) setback from the ordinary high water mark. Etc.....	water

K-2 Lease Stipulation/Best Management Practice – Deep Water Lakes **Note:** This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternatives, K-2 would be a best management practice. Objective: Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of deep water lakes; the loss of spawning, rearing or over wintering habitat for fish; the loss of cultural and paleontological resources; impacts to subsistence cabin and campsites; and the disruption of subsistence activities. Requirement/Standard: Generally, permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited on the lake or lakebed and within 0.25 mile of the ordinary high watermark of any deep lake as determined to be in lake zone III (i.e., depth greater than 13 feet [4 meters]; Mellor 1985). On a case-by-case basis in consultation with federal, State and North Slope Borough regulatory and resource agencies (as appropriate based on agency legal authority and jurisdictional responsibility), essential pipeline(s), road crossings, and other permanent facilities may be considered through the permitting process in these areas where the lessee can demonstrate on a site-specific basis that impacts will be minimal.	water
K-3a Stipulation – Teshekpuk Lake Shoreline **NOTE: this applies only to Alternative C.** Alternatives B-1 and B-2 have no comparable provision because no non-subsistence permanent infrastructure would be allowed within the Teshekpuk Lake shoreline area. Alternative D also has no comparable provision, but note that Teshekpuk Lake is a deep water lake to which Stipulation K-2 applies. Objective: Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of this large and regionally significant deep water lake; the loss of cultural and paleontological resources; impacts to subsistence cabins, campsites and associated activities; and to protect fish and wildlife habitat including important insect-relief areas. Requirement/Standard: Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited within 0.25 mile of the ordinary high watermark of Teshekpuk Lake. In addition, no permanent oil and gas facilities, except pipelines, will be allowed in portions of T1;4-15 N, R9W, and T15N, R8W, U.M. greater than 0.25 mile of the ordinary high watermark of Teshekpuk Lake as depicted on Map 2-3K. (No waiver, exception, or modification will be approved.)	water (NA)

K-3b Lease Stipulation/Best Management Practice – Kogru River, Dease Inlet, Admiralty Bay, Elson Lagoon, Peard Bay, Wainwright Inlet/Kuk River, and Kasegaluk Lagoon, and their associated Islands **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-3b would be a best management practice. Alternatives B-1 and C, and, to a lesser extent, Alternative B-2, would generally prohibit non-subsistence permanent infrastructure in these waters. Objective: Protect fish and wildlife habitat (including, but not limited to, that for waterfowl and shorebirds, caribou insect-relief, and marine mammals), preserve air and water quality, and minimize impacts to subsistence activities and historic travel routes on the major coastal waterbodies. Requirement/Standard (Exploration): Oil and gas exploration operations (e.g., drilling, seismic exploration, and testing) are not allowed on the major coastal waterbodies and coastal islands between May 15 and October 15 of each season. Requests for approval of any activities must be submitted in advance and must be accompanied by evidence and documentation that demonstrates to the satisfaction of the authorized office that the actions or activities meet all of the following criteria: a. Exploration activities will not unreasonably conflict with subsistence uses or significantly impact seasonally concentrated fish and wildlife resources. b. There is adequate spill response capability to effectively respond during periods of broken ice and/or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include improvements in blowout prevention technology, equipment and/or changes in operational procedures and "top-setting" of hydrocarbon-bearing zones. c. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic will be conducted to minimize additional impacts or further compounding of "direct spill" related impacts on area resources and subsistence uses. d. The location of exploration and related activities shall be sited so as to not pose a hazard to navigation by the public using high-use subsistence-related travel routes into and through the major coastal waterbodies, as identified by the North Slope Borough, recognizing that marine and nearshore travel routes change over time, subject to shifting environmental conditions.	water

Continued.....K-3b Lease Stipulation/Best Management Practice – Kogru River, Dease Inlet, Admiralty Bay, Elson Lagoon, Peard Bay, Wainwright Inlet/Kuk River, and Kasegaluk Lagoon, and their associated Islands e. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope. Requirement/Standard (Development): With the exception of linear features such as pipelines, no permanent oil and gas facilities are permitted on or under the water within 0.75 mile seaward of the shoreline (as measured from mean high tide) of the major coastal waterbodies or the natural coastal islands (to the extent that the seaward subsurface is within NPR-A). Elsewhere, permanent facilities within the major coastal waterbodies will only be permitted on or under the water if they can meet all the following criteria: f. Design and construction of facilities shall minimize impacts to subsistence uses, travel corridors, seasonally concentrated fish and wildlife resources. g. Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, alone or in combination with other past, present, and reasonably foreseeable activities, shall be conducted to minimize impacts to subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources. h. The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through the major coastal waterbodies as identified by the North Slope Borough. i. Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include seasonal drilling restrictions, improvements in blowout prevention technology, equipment and/or changes in operational procedures, and “top-setting” of hydrocarbon-bearing zones. j. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts or further compound “direct spill” related impacts on area resources and subsistence uses. k. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope.	water

K-8b Best Management Practice – Kasegaluk Lagoon Special Area **Note: This applies only to Alternatives B-1 and C**. There would be no comparable provision for Alternatives B-2 and D. This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-8b would be a best management practice Objective: Protect the habitat of the fish, waterfowl, and terrestrial and marine wildlife resources of Kasegaluk Lagoon, and protect subsistence uses and public access to and through Kasegaluk Lagoon for current and future generations of North Slope residents. Requirement/Standard: No permanent oil and gas surface facilities are permitted in the Kasegaluk Lagoon and an area one mile inland from the lagoon.	water
SUMMER VEHICLE TUNDRA ACCESS ***L-1 Best Management Practice*** Objective: Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities. Requirement/Standard: On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Best management Practice C-2a. Permission for such use would only be granted after an applicant has: a. Submitted studies satisfactory to the authorized officer of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation. b. Submitted surveys satisfactory to the authorized officer of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.	wildlife, vegetation, water, birds

WINTER OVERLAND MOVES AND SEISMIC WORK				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
C-2 Best Management Practice Objective: Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation. Requirement/Standard: a. Ground operations shall be allowed only when frost and snow cover are at sufficient depths to protect the tundra. Ground operations shall cease when the spring snowmelt begins (approximately May 5 in the foothills area where elevations reach or exceed 500 feet and approximately May 15 in the northern coastal areas). The exact dates will be determined by the authorized officer. b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. Low- ground-pressure vehicles shall be selected and operated in a manner that eliminates direct impacts to the tundra by shearing, scraping, or excessively compacting the tundra mat. **Note**: This provision does not include the use of heavy equipment such as front-end loaders and similar equipment required during ice road construction. c. Bulldozing of tundra mat and vegetation, trails, or seismic lines is prohibited; however, on existing trails, seismic lines or camps, clearing of drifted snow is allowed to the extent that the tundra mat is not disturbed. d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles such as Rolligons. e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year. f. Motorized ground-vehicle use within the Colville River Special Area associated with overland moves, seismic work, and any similar use of heavy equipment shall be minimized within an area that extends 1 mile west or northwest of the bluffs of the Colville River, and 2 miles on either side of the Kogosukruk and Kikiakrorak rivers and tributaries of the Kogosukruk River from April 15 through August 5, with the exception that use will be minimized in the vicinity of gyrfalcon nests beginning March 15. Such use will remain 0.5 mile away from known raptor nesting sites, unless authorized by the authorized officer.			vegetation

ENDANGERED SPECIES ACT—SECTION 7 CONSULTATION PROCESS ***J.*** The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that will contribute to the need to list such a species or their habitat. The BLM may require modifications to or disapprove a proposed activity 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 as amended, 16 USC § 1531 et seq., including completion of any required procedure for conference or consultation.	Wildlife, vegetation, birds
ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS	
K-8a Lease Stipulation – Pik Dunes **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-8a would be a best management practice. Objective: Retain unique qualities of the Pik Dunes, including geologic and scenic uniqueness, insect-relief habitat for caribou, and habitat for several uncommon plant species. Requirement/Standard: Surface structures, except approximately perpendicular pipeline crossings and ice pads, are prohibited within the Pik Dunes.	vegetation

SUMMER VEHICLE TUNDRA ACCESS ***L-1 Best Management Practice*** Objective: Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities. Requirement/Standard: On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Best management Practice C-2a. Permission for such use would only be granted after an applicant has: a. Submitted studies satisfactory to the authorized officer of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation. b. Submitted surveys satisfactory to the authorized officer of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.	wildlife, vegetation, water, birds
M-3 Best Management Practice **NOTE**: **This best management practice is applicable only to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: Minimize loss of populations of, and habitat for, plant species designated as Sensitive by the BLM in Alaska. Requirement/Standard: If a development is proposed in an area that provides potential habitat for a BLM Sensitive Plant Species, the development proponent would conduct surveys at appropriate times of the summer season and in appropriate habitats for the Sensitive Plant Species that might occur there. The results of these surveys will be submitted to the BLM with the application for development.	vegetation

FACILITY DESIGN AND CONSTRUCTION				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
E-7 Best Management Practice Objective: Minimize disruption of caribou movement and subsistence use. Requirement/Standard: Pipelines and roads shall be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in subsistence activities. Listed below are the accepted design practices: a. Above-ground pipelines shall be elevated a minimum of 7 feet as measured from the ground to the bottom of the pipeline at vertical support members. b. In areas where facilities or terrain may funnel caribou movement, ramps over pipelines, buried pipelines, or pipelines buried under roads may be required by the authorized officer after consultation with federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility). c. A minimum distance of 500 feet between pipelines and roads shall be maintained. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad. Where it is not feasible to separate pipelines and roads, alternative pipeline routes, designs and possible burial within the road will be considered by the authorized officer. d. Above-ground pipelines shall have a non-reflective finish.				caribou, subsistence
E-19 Best Management Practice Objective: Provide information to be used in monitoring and assessing wildlife movements during and after construction. Requirement/Standard: A representation, in the form of ArcGIS-compatible shape-files, of all new infrastructure construction shall be provided to the authorized officer. During the planning and permitting phase, shape-files representing proposed locations shall be provided. Within 6 months of construction completion, shape-files (within GPS accuracy) of all new infrastructure shall be provided. Infrastructure includes all gravel roads and pads, facilities built on pads, pipelines and independently constructed powerlines (as opposed to those incorporated in pipeline design). Gravel pads shall be included as polygon feature. Roads, pipelines, and powerlines may be represented as line features but must include ancillary data to denote width, number pipes, etc. Poles for power lines may be represented as point features. Ancillary data shall include construction beginning and ending dates.				caribou, wildlife
ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	

K-5a Lease Stipulation/Best Management Practice –Teshekpuk Lake Caribou Habitat Area **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-5a would be a best management practice. Under Alternatives B-1, B-2 and C the Teshekpuk Lake Caribou Habitat Area encompasses those lands designated as such in the Northeast NPR-A Supplemental IAP Record of Decision and the Caribou Study Area in the Northwest NPR-A IAP Record of Decision as well as additional lands south of the area as defined in Alternative A. Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements through portions the Teshekpuk Lake Caribou Habitat Area that are essential for all season use, including calving and rearing, insect-relief, and migration. Requirement/Standard: In the Teshekpuk Lake Caribou Habitat Area the following standards will be applied to permitted activities: a. Before authorization of construction of permanent facilities (limited as they may be by restricted surface occupancy areas established in other lease stipulations), the lessee shall design and implement and report a study of caribou movement unless an acceptable study(s) specific to the Teshekpuk Caribou Herd has been completed within the last 10 years. The study shall include a minimum of four years of current data on the Teshekpuk Caribou Herd movements and the study design shall be approved by the authorized officer in consultation with the appropriate federal, State, and North Slope Borough wildlife and resource agencies. The study should provide information necessary to determine facility (including pipeline) design and location. Lessees may submit individual study proposals or they may combine with other lessees in the area to do a single, joint study for the entire Teshekpuk Lake Caribou Habitat Area. Study data may be gathered concurrently with other activities as approved by the authorized officer and in consultation with the appropriate federal, State, and North Slope Borough wildlife and resource agencies. A final report of the study results will be prepared and submitted. Prior to the permitting of a pipeline in the Teshekpuk Lake Caribou Habitat Area, a workshop will be convened to identify the best corridor for pipeline construction in efforts to minimize impacts to wildlife (specifically the Teshekpuk Caribou Herd) and subsistence resources. The workshop participants will include but will not be limited to federal, State, and North Slope Borough representatives. All of these modifications will increase protection for caribou and other wildlife that utilize the Teshekpuk Lake Caribou Habitat Area during all seasons.	***K-5a Lease Stipulation– Teshekpuk Lake Caribou Habitat Area*** Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements through portions the Teshekpuk Lake Caribou Habitat Area (see Map 2-4K) that are essential for all season use, including calving and rearing, insect-relief, and migration. Requirement/Standard: Same as Alternatives B-1 through C.	caribou

K-5a Lease Stipulation/Best Management Practice –Teshekpuk Lake Caribou Habitat Area Continued 2. The lessee or a contractor shall observe caribou movement from May 20 through August 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic will be stopped: a. temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou appears to be imminent. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. b. by direction of the authorized officer throughout a defined area for up to four weeks to prevent displacement of calving caribou. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable. 3. Major equipment, materials, and supplies to be used at oil and gas work sites in the Teshekpuk Lake Caribou Habitat Area shall be stockpiled prior to or after the period of May 20 through August 20 to minimize road traffic during that period.	Con'td	caribou

K-5a Lease Stipulation/Best Management Practice –Teshekpuk Lake Caribou Habitat Area Continued 4. Within the Teshekpuk Lake Caribou Habitat Area aircraft use (including fixed wing and helicopter) shall be restricted from May 20 through August 20 unless doing so endangers human life or violates safe flying practices. Authorized users of the NPR-A may be restricted from using aircraft larger than a Twin Otter, and limited to an average of one fixed-wing aircraft takeoff and landing per day per airstrip, except for emergency purposes. Restrictions may include prohibiting the use of aircraft larger than a Twin Otter by authorized users of the NPR-A, including oil and gas lessees, from May 20 through August 20 within the Teshekpuk Lake Caribou Habitat Area, except for emergency purposes. The lessee shall submit with the development proposal an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. Adjustments, including perhaps suspension of all aircraft use, will be required by the authorized officer if resulting disturbance is determined to be unacceptable. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data. 5. Aircraft shall maintain a minimum height of 1,000 feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, and 2,000 feet above ground level over the Teshekpuk Lake Caribou Habitat Area from May 20 through August 20, unless doing so endangers human life or violates safe flying practices. Caribou wintering ranges will be defined annually by the authorized officer in consultation with the Alaska Department of Fish and Game. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.	Con'td	caribou
K-5b Best Management Practice – Caribou Study Area **NOTE: This applies only to Alternative D**. Alternatives B1-, B-2, and C are incorporated into K-5a Stipulation, above. Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements in the Caribou Study Area. Requirement/ Standard: Before authorization of construction of permanent facilities, the lessee shall design and implement a study of caribou movement, especially during the insect season. The study would include a minimum of 3 years of current data on caribou movements. The study design shall be approved by the authorized officer and should provide information necessary to determine facility (including pipeline) design and location. Lessees may submit individual study proposals or they may combine with other lessees in the area to do a single, joint study for the entire Caribou Study Area. Study data may be gathered concurrently with other activities.		caribou

K-6 Lease Stipulation – Coastal Area (Alternatives B-1, C, and D) **Note:** This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-6 would be a best management practice. Objective: Minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; to protect the summer shoreline habitat for polar bears, walrus, and seals; to prevent contamination of marine waters; loss of important bird habitat; alteration or disturbance of shoreline marshes; and impacts to subsistence resources activities. Requirement/Standard: No permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines established to support exploration and development activities shall be located in the Coastal Area, which includes all barrier and offshore islands within NPR-A and a coastal strip extending 0.75 mile inland from the coast. (In Alternatives B-1 and C, the coastal strip between the Kogru River and Tangent Point would extend 1 mile inland, instead of 0.75 mile, in order to protect molting geese habitat.) Where, as a result of technological limitations, economics, logistics, or other factors, a facility must be located within 0.75 mile inland of the coastline (Alternatives B-1 and C, 1 mile inland between Kogru River and Tangent Point), the practicality of locating the facility at previously occupied sites such as Camp Lonely, various Husky/USGS drill sites, and Distant Early Warning-Line sites, shall be considered. Use of existing sites within 0.75 mile of the coastline (Alternatives B-1 and C, 1 mile inland between Kogru River and Tangent Point) shall also be acceptable where it is demonstrated that use of such sites will reduce impacts to shorelines or otherwise be environmentally preferable. All lessees/permittees involved in activities in the immediate area must coordinate use of these new or existing sites with all other prospective users. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, the Nuiqsut Whaling Captains' Association, and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope. In a case in which the BLM authorizes a permanent oil and gas facility within the Coastal Area, the lessee/permittee shall develop and implement a monitoring plan to assess the effects of the facility and its use on coastal habitat and use.	polar bears, caribou

K-6 Lease Stipulation – Coastal Area (Alternative B-2 only) Objective: Protect coastal waters and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; protect the summer and winter shoreline habitat for polar bears, and the summer shoreline habitat for walrus and seals; prevent loss of important bird habitat and alteration or disturbance of shoreline marshes; and prevent impacts to subsistence resources activities. Requirement/Standard: a. Exploratory well drill pads, production well drill pads, or a central processing facility for oil or gas would not be allowed in coastal waters or on islands between the northern boundary of the Reserve and the mainland, or in inland areas within one mile of the coast. (Note: This would include the entirety the Kasegaluk Lagoon and Peard Bay Special Areas.) Other facilities necessary for oil and gas production within NPR-A that necessarily must be within this area (e.g., barge landing, seawater treatment plant, or spill response staging and storage areas) would not be precluded. Nor would this stipulation preclude infrastructure associated with offshore oil and gas exploration and production or construction, renovation, or replacement of facilities on existing gravel sites. Lessees/permittees shall consider the practicality of locating facilities that necessarily must be within this area at previously occupied sites such as various Husky/USGS drill sites and Distant Early Warning-Line sites. All lessees/permittees involved in activities in the immediate area must coordinate use of these new or existing sites with all other prospective users. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, the North Slope Borough, and local whaling captains associations to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope. In a case in which the BLM authorizes a permanent oil and gas facility within the Coastal Area, the lessee/permittee shall develop and implement a monitoring plan to assess the effects of the facility and its use on coastal habitat and use. b. Marine vessels used as part of a BLM-authorized activity shall maintain a 1-mile buffer from the shore when transiting past an aggregation of seals (primarily spotted seals) using a terrestrial haulout unless doing so would endanger human life or violate safe boating practices. Marine vessels shall not conduct ballast transfers or discharge any matter into the marine environment within 3 miles of the coast except when necessary for the safe operation of the vessel. c. Marine vessels used as part of a BLM-authorized activity shall maintain a 0.5-mile buffer from shore when transiting past an aggregation of walrus using a terrestrial haulout.	polar bears, caribou

K-9 Lease Stipulation/Best Management Practice – Teshekpuk Lake Caribou Movement Corridors **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-9 would be a best management practice. Alternatives B-1 and B-2 would generally prohibit non-subsistence permanent infrastructure in all, or nearly all, of these areas. Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements (that are essential for all season use, including calving and rearing, insect-relief, and migration) in the area extending from the eastern shore of Teshekpuk Lake eastward to the Kogru River and the area between Teshekpuk Lake and an unnamed lake in T16-17 N, R8 W, U.M. Requirement/Standard: Within the Caribou Movement Corridors, no permanent oil and gas facilities, except for pipelines or, in the case of Alternative B-2 only other infrastructure associated with offshore oil and gas exploration and production, will be allowed on the approximately 62,100 (approximately 50,800 acres east of Teshekpuk Lake, and approximately 11,300 acres northwest of Teshekpuk Lake) illustrated on Map 2-3K. Prior to the permitting of permanent oil and gas infrastructure in the Caribou Movement Corridors, a workshop will be convened to identify the best corridor for pipeline construction in efforts to minimize impacts to wildlife and subsistence resources. The workshop participants will include but will not be limited to federal, State, and North Slope Borough representatives.	No comparable provision.	caribou
K-10 Lease Stipulation/Best Management Practice – Teshekpuk Lake Southern Caribou Calving Area **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-10 would be a best management practice. Alternatives B-1 and B-2 would generally prohibit non-subsistence permanent infrastructure in all, or nearly all, of this area. Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements (that are essential for all season use, including calving and post calving, and insect-relief) in the area south/southeast of Teshekpuk Lake. Requirement/Standard: Within the Southern Caribou Calving Area, no permanent oil and gas facilities, except pipelines or, in the case of Alternative B-2 only other infrastructure associated with offshore oil and gas exploration and production, will be allowed on the approximately 240,000 acres illustrated on Map 2-3K. Prior to the permitting of permanent oil and gas infrastructure in the Southern Caribou Calving Area, a workshop will be convened to identify the best corridor for pipeline construction in efforts to minimize impacts to wildlife and subsistence resources. The workshop participants will include but will not be limited to federal, State, and North Slope Borough representatives.	No comparable provision.	caribou

ALT D ONLY: K-11 Lease Stipulation – Lease Tracts A-G Objective: To protect key surface resources and subsistence resources/activities resulting from permanent oil and gas development and associated activities. Requirement Standard: Permanent surface disturbance resulting from oil and gas activities is limited to 300 acres within the following described lease tracts (Maps 2-3K and 2-4K); this does not include surface disturbance activities from pipeline construction. Existing gravel pads within these tracts would not count against the 300-acre limit. A pipeline will be considered for development of one or more of these tracts after a workshop is convened to identify the best corridor for pipeline construction in efforts to minimize impacts to wildlife and subsistence resources. The workshop participants will include but need not be limited to Federal, state, and North Slope Borough representatives. (No alternative procedures will be approved). (Acreages are based on GIS calculations and are approximate): A. Total Acreage: approximately 52,700: The total new development footprint cannot exceed 300 acres (0.6% of total acreage). B. Total Acreage: approximately 55,000: The total new development footprint cannot exceed 300 acres (0.5% of total acreage). C. Total Acreage: approximately 46,100: The total new development footprint cannot exceed 300 acres (0.7% of total acreage). D. Total Acreage: approximately 54,500: The total new development footprint cannot exceed 300 acres (0.6% of total acreage). E. Total Acreage: approximately 56,500: The total new development footprint cannot exceed 300 acres (0.5% of total acreage). F. Total Acreage: approximately 57,100: The total new development footprint cannot exceed 300 acres (0.5% of total acreage). G. Total Acreage: approximately 56,800: The total new development footprint cannot exceed 300 acres (0.5% of total acreage).	caribou

K-12 Lease Stipulation/Best Management Practice – Western Arctic Herd Habitat Area **Note:** This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-12 would be a best management practice. In each of the alternatives, this stipulation applies to the configuration of the Utukok River Uplands Special Area proposed for the respective alternative. Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements through the Utukok River Uplands Special Area that are essential for all season use, including calving and rearing, insect-relief, and migration. Requirement/Standard: In the Utukok River Uplands Special Area the following standards will be applied to permitted activities: a. Before authorization of construction of permanent facilities, the lessee shall design and implement and report a study of caribou movement unless an acceptable study(s) specific to the Western Arctic Herd has been completed within the last 10 years. The study shall include a minimum of four years of current data on the Western Arctic Herd's movements and the study design shall be approved by the authorized officer in consultation with the appropriate federal, State, and North Slope Borough wildlife and resource agencies and the Western Arctic Caribou Herd Working Group. The study should provide information necessary to determine facility (including pipeline) design and location. Lessees may submit individual study proposals or they may combine with other lessees in the area to do a single, joint study for the entire Utukok River Uplands Special Area. Study data may be gathered concurrently with other activities as approved by the authorized officer and in consultation with the appropriate federal, State, and North Slope Borough wildlife and resource agencies. A final report of the study results will be prepared and submitted. Prior to the permitting of a pipeline in the Utukok River Uplands Special Area, a workshop will be convened to identify the best corridor for pipeline construction in efforts to minimize impacts to wildlife (specifically the Western Arctic Herd) and subsistence resources. The workshop participants will include but will not be limited to federal, State, and North Slope Borough representatives. All of these modifications will increase protection for caribou and other wildlife that utilize the Utukok River Uplands Special Area during all seasons. b. Within the Utukok River Uplands Special Area, lessees shall orient linear corridors when laying out oil and gas field developments to address migration and corralling effects and to avoid loops of road and/or pipeline that connect facilities. c. Ramps over pipelines, buried pipelines, or pipelines buried under the road may be required by the authorized officer, after consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies, in the Utukok River Uplands Special Area where pipelines potentially impede caribou movement.	caribou

continued....K-12 Lease Stipulation/Best Management Practice – Western Arctic Herd Habitat Area d. Major construction activities using heavy equipment (e.g., sand/gravel extraction and transport, pipeline and pad construction, but not drilling from existing production pads) shall be suspended within Utukok River Uplands Special Area from May 20 through August 20, unless approved by the authorized officer in consultation with the appropriate federal, State, and North Slope Borough regulatory and resource agencies. The intent of this requirement is to restrict activities that will disturb caribou during calving and insect-relief periods. If caribou arrive on the calving grounds prior to May 20, major construction activities will be suspended. The lessee shall submit with the development proposal a "stop work" plan that considers this and any other mitigation related to caribou early arrival. The intent of this latter requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of fields in the region. e. The following ground and air traffic restrictions shall apply to permanent oil and gas-related roads in the areas and time periods indicated: 1. Within the Utukok River Uplands Special Area, from May 20 through August 20, traffic speed shall not exceed 15 miles per hour when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips, using convoys, using different vehicle types, etc., to the extent practicable. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable. 2. The lessee or a contractor shall observe caribou movement from May 20 through August 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic will be stopped: a. Temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou appears to be imminent. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. b. By direction of the authorized officer throughout a defined area for up to four weeks to prevent displacement of calving caribou. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable. 3. Major equipment, materials, and supplies to be used at oil and gas work sites in the Utukok River Uplands Special Area shall be stockpiled prior to or after the period of May 20 through August 20 to minimize road traffic during that period.	caribou

Continued K-12 Lease Stipulation/Best Management Practice – Western Arctic Herd Habitat Area 4. Within the Utukok River Uplands Special Area aircraft use (including fixed wing and helicopter) shall be restricted from May 20 through August 20 unless doing so endangers human life or violates safe flying practices. Authorized users of the NPR-A may be restricted from using aircraft larger than a Twin Otter, and limited to an average of one fixed-wing aircraft takeoff and landing per day per airstrip, except for emergency purposes. Restrictions may include prohibiting the use of aircraft larger than a Twin Otter by authorized users of the NPR-A, including oil and gas lessees, from May 20 through August 20 within the Utukok River Uplands Special Area, except for emergency purposes. The lessee shall submit with the development proposal an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. Adjustments, including perhaps suspension of all aircraft use, will be required by the authorized officer if resulting disturbance is determined to be unacceptable. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data. 5. Aircraft shall maintain a minimum height of 1,000 feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, and 2,000 feet above ground level over the Utukok River Uplands Special Area from May 20 through August 20, unless doing so endangers human life or violates safe flying practices. Caribou wintering ranges will be defined annually by the authorized officer in consultation with the Alaska Department of Fish and Game. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.	caribou

WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
A-8 Best Management Practice Objective: Minimize conflicts resulting from interaction between humans and bears during oil and gas activities. Requirement/Standard: Oil and gas lessees and their contractors and subcontractors will, as a part of preparation of lease operation planning, prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These plans shall include measures to: a. Minimize attraction of bears to the work sites. b. Organize layout of buildings and work sites to minimize human/bear interactions. c. Warn personnel of bears near or on work sites and identify proper procedures to be followed. d. Establish procedures, if authorized, to discourage bears from approaching the work site. e. Provide contingencies in the event bears do not leave the work site or cannot be discouraged by authorized personnel. f. Discuss proper storage and disposal of materials that may be toxic to bears. g. Provide a systematic record of bears on the work site and in the immediate area				wildlife, polar bears
WINTER OVERLAND MOVES AND SEISMIC WORK				
The following required operating procedures/best management practices apply to overland moves, seismic work, and any similar cross-country vehicle use of heavy equipment on non-roaded surfaces during the winter season. These restrictions do not apply to the use of such equipment on ice roads after they are constructed.				
C-1 Best Management Practice Objective: Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations. Requirement/Standard: a. Cross-country use of heavy equipment and seismic activity is prohibited within 0.5 mile of occupied grizzly bear dens identified by the Alaska Department of Fish and Game unless alternative protective measures are approved by the authorized officer in consultation with the Alaska Department of Fish and Game. b. Cross-country use of heavy equipment and seismic activity is prohibited within 1 mile of known or observed polar bear dens or seal birthing lairs. Operators near coastal areas shall conduct a survey for potential polar bear dens and seal birthing lairs and consult with the USFWS and/or NOAA Fisheries, as appropriate, before initiating activities in coastal habitat between October 30 and April 15.				polar bears, wildlife

K-6 Lease Stipulation – Coastal Area (Alternatives B-1, C, and D) **Note:** This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-6 would be a best management practice. Objective: Minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; to protect the summer shoreline habitat for polar bears, walrus, and seals; to prevent contamination of marine waters; loss of important bird habitat; alteration or disturbance of shoreline marshes; and impacts to subsistence resources activities. Requirement/Standard: No permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines established to support exploration and development activities shall be located in the Coastal Area, which includes all barrier and offshore islands within NPR-A and a coastal strip extending 0.75 mile inland from the coast. (In Alternatives B-1 and C, the coastal strip between the Kogru River and Tangent Point would extend 1 mile inland, instead of 0.75 mile, in order to protect molting geese habitat.) Where, as a result of technological limitations, economics, logistics, or other factors, a facility must be located within 0.75 mile inland of the coastline (Alternatives B-1 and C, 1 mile inland between Kogru River and Tangent Point), the practicality of locating the facility at previously occupied sites such as Camp Lonely, various Husky/USGS drill sites, and Distant Early Warning-Line sites, shall be considered. Use of existing sites within 0.75 mile of the coastline (Alternatives B-1 and C, 1 mile inland between Kogru River and Tangent Point) shall also be acceptable where it is demonstrated that use of such sites will reduce impacts to shorelines or otherwise be environmentally preferable. All lessees/permittees involved in activities in the immediate area must coordinate use of these new or existing sites with all other prospective users. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, the Nuiqsut Whaling Captains' Association, and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope. In a case in which the BLM authorizes a permanent oil and gas facility within the Coastal Area, the lessee/permittee shall develop and implement a monitoring plan to assess the effects of the facility and its use on coastal habitat and use.	polar bears, caribou

FACILITY DESIGN AND CONSTRUCTION				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
E-9 Best Management Practice Objective: Avoidance of human-caused increases in populations of predators of ground-nesting birds. Requirement/Standard: a. Lessee shall utilize best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee shall provide the authorized officer with an annual report on the use of oil and gas facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites. b. Feeding of wildlife is prohibited and will be subject to non-compliance regulations.				wildlife, birds
E-10 Best Management Practice Objective: Prevention of migrating waterfowl, including species listed under the Endangered Species Act, from striking oil and gas and related facilities during low light conditions. Requirement/Standard: Illumination of all structures between August 1 and October 31 shall be designed to direct artificial exterior lighting inward and downward, rather than upward and outward, unless otherwise required by the Federal Aviation Administration.				birds

E-11 Best Management Practice Objective: Minimize the take of bird species, particularly those listed under the Endangered Species Act and BLM Special Status Species from direct or indirect interaction with oil and gas facilities. Requirement/Standard: In accordance with the guidance below, before the approval of facility construction, aerial surveys of the following species shall be conducted within any area proposed for development. *Special Conditions in Spectacled and/or Steller's Eiders Habitats:* a. Surveys shall be conducted by the lessee for at least 3 years before authorization of construction, if such construction is within the USFWS North Slope eider survey area and at least 1 year outside that area. Results of aerial surveys and habitat mapping may require additional ground nest surveys. Spectacled and/or Steller's eider surveys shall be conducted following accepted BLM-protocol. Information gained from these surveys shall be used to make infrastructure siting decisions as discussed in subparagraph b, below. b. If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall work with the USFWS and BLM early in the design process to site roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and their preferred habitats. Such consultation shall address timing restrictions and other temporary mitigating measures, location of permanent facilities, placement of fill, alteration of eider habitat, aircraft operations, and management of high noise levels. c. To reduce the possibility of spectacled and/or Steller's eiders (and, under Alternatives B-1, B-2, and C only, other birds) colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases which are to be few in number and limited in extent. Exceptions are limited to the following situations, and must be reported to the USFWS when exceptions are authorized: 1. Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad; 2. Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or 3. Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods.	birds

Continued E-11 Best Management Practice *cont'd Special Conditions in Spectacled and/or Steller's Eiders Habitats:* d. To reduce the likelihood of spectacled and/or Steller's eiders (and, under Alternatives B-1, B-2, and C only, other birds) colliding with communication towers, towers should be located, to the extent practicable, on existing pads and as close as possible to buildings or other structures, and on the east or west side of buildings or other structures if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low-flying birds. Such markings shall be developed through consultation with the USFWS. *Conditions in Yellow-billed Loon Habitats:* a. Aerial surveys shall be conducted by the lessee for at least 3 years before authorization of construction of facilities proposed for development which are within 1 mile of a lake 25 acres or larger in size. These surveys along shorelines of large lakes shall be conducted following accepted BLM protocol during nesting in late June and during brood rearing in late August. b. Should yellow-billed loons be present, the design and location of facilities must be such that disturbance is minimized. The default standard mitigation is a 1-mile buffer around all recorded nest sites and a minimum 1,625-foot (500-meter) buffer around the remainder of the shoreline. Development will generally be prohibited within buffers unless no other option exists.	birds
Continued E-11 Best Management Practice *Protections for Birds* a. To reduce the possibility of birds colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases, which are to be few in number and limited in extent. Exceptions are limited to the following situations: 1. Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad; 2. Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or 3. Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods. b. To reduce the likelihood of birds colliding with communication towers, towers should be located, to the extent practicable, on existing pads and as close as possible to buildings or other structures, and on the east or west side of buildings or other structures if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low-flying birds. Such markings shall be developed through consultation with the USFWS.	birds

E-15 Best Management Practice Objective: Prevent or minimize the loss of nesting habitat for cliff nesting raptors. Requirement/Standard: a. Removal of greater than 100 cubic yards of bedrock outcrops, sand, and/or gravel from cliffs shall be prohibited. b. Any extraction of sand and/or gravel from an active river or stream channel shall be prohibited unless preceded by a hydrological study that indicates no potential impact by the action to the integrity of the river bluffs.	birds
E-18 Best Management Practice Objective: Avoid and reduce temporary impacts to productivity from disturbance near Steller's and/or spectacled eider nests. Requirement/Standard: Ground-level activity (by vehicle or on foot) within 200 meters of occupied Steller's and/or spectacled eider nests, from June 1 through August 15, will be restricted to existing thoroughfares, such as pads and roads. Construction of permanent facilities, placement of fill, alteration of habitat, and introduction of high noise levels within 200 meters of occupied Steller's and/or spectacled eider nests will be prohibited. In instances where summer (June 1 through August 15) support/construction activity must occur off existing thoroughfares, USFWS-approved nest surveys must be conducted during mid-June prior to the approval of the activity. Collected data will be used to evaluate whether the action could occur based on employment of a 200-meter buffer around nests or if the activity would be delayed until after mid-August once ducklings are mobile and have left the nest site. The BLM will also work with the USFWS to schedule oil spill response training in riverine, marine, and inter-tidal areas that occurs within 200 meters of shore outside sensitive nesting/brood-rearing periods or conduct nest surveys. The protocol and timing of nest surveys for Steller's and/or spectacled eiders will be determined in cooperation with the USFWS, and must be approved by the USFWS. Surveys should be supervised by biologists who have previous experience with Steller's and/or spectacled eider nest surveys.	birds
ENDANGERED SPECIES ACT—SECTION 7 CONSULTATION PROCESS	
J. The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that will contribute to the need to list such a species or their habitat. The BLM may require modifications to or disapprove a proposed activity 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 as amended, 16 USC § 1531 et seq., including completion of any required procedure for conference or consultation.	Wildlife, vegetation, birds

K-4a Lease Stipulation/Best Management Practice – Goose Molting Area Continued f. Strategies to minimize ground traffic shall be implemented from June 15 through August 20. These strategies may include limiting trips, use of convoys, different vehicle types, etc. to the extent practicable. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable. g. Within the Goose Molting Area aircraft use (including fixed wing and helicopter) shall be restricted from June 15 through August 20 unless doing so endangers human life or violates safe flying practices. Restrictions may include: (1) limiting flights to two round-trips/week, and (2) limiting flights to corridors established by the BLM after discussions with appropriate federal, State, and North Slope Borough regulatory and resource agencies. The lessee shall submit with the development proposal an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. Adjustments, including perhaps suspension of all aircraft use, will be required by the authorized officer if resulting disturbance is determined to be unacceptable. **Note:** This site-specific lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data. h. Any permit for development issued under this IAP/EIS will include a requirement for the lessee to conduct monitoring studies necessary to adequately determine consequences of development and any need for change to mitigations. Monitoring studies will be site- and development-specific within a set of over-arching guidelines developed by the BLM after conferring with appropriate federal, State, North Slope Borough agencies. The study(ies) will include the construction period and will continue for a minimum of 3 years after construction has been completed and production has begun. The monitoring studies will be a continuation of evaluating the effectiveness of Stipulation K-4a's requirements in meeting the objective of K-4 and determine if any changes to the lease stipulation or any project specific mitigation(s) are necessary. If changes are determined to be necessary, the BLM, with the lessee and/or their representative, will conduct an assessment of the feasibility of altering development operation (e.g., reduced human activity, visibility barriers, noise abatement). Any changes determined necessary will be implemented prior to authorization of any new construction.	birds cont

K-4b Best Management Practice – Brant Survey Area Objective: Minimize the loss or alteration of habitat for, or disturbance of, nesting and brood rearing brant in the Brant Survey Area. Requirement/Standard: a. Aerial surveys for brant nesting colonies and brood-rearing areas shall be conducted for a minimum of 2 years before authorization of construction of permanent facilities. At a minimum, the survey area shall include the proposed development site(s) (i.e., the footprint) and the surrounding 0.5-mile area. These surveys shall be conducted following accepted BLM protocol. b. Development may be prohibited or activities curtailed within 0.5 mile of all identified brant nesting colonies and brood-rearing areas identified during the 2-year survey.					birds
K-7 Lease Stipulation – Colville River Special Area **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-7 would be a best management practice Objective: Prevent or minimize loss of raptor foraging habitat (also see Lease Stipulation K-1; Rivers Area). Requirement/Standard for Facilities: If necessary to construct permanent facilities within the Colville River Special Area, all reasonable and practicable efforts shall be made to locate permanent facilities as far from raptor nests as feasible. Additionally, within 15 miles of raptor nest sites, significant alteration of high quality foraging habitat shall be prohibited unless the lessee can demonstrate on a site-specific basis that impacts would be minimal. Of particular concern are ponds, lakes, wetlands, and riparian habitats. **Note:** On a case-by-case basis, and in consultation with appropriate federal and State regulatory and resource agencies, essential pipeline and road crossings will be permitted through the Colville River Special Area where no other feasible or prudent options are available.				No comparable provision.	birds
SUMMER VEHICLE TUNDRA ACCESS					

L-1 Best Management Practice Objective: Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities. Requirement/Standard: On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Best management Practice C-2a. Permission for such use would only be granted after an applicant has: a. Submitted studies satisfactory to the authorized officer of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation. b. Submitted surveys satisfactory to the authorized officer of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.	wildlife, vegetation, water, birds

WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
A-2 Best Management Practice Objective: Minimize impacts on the environment from non-hazardous and hazardous waste generation. Encourage continuous environmental improvement. Protect the health and safety of oil and gas field workers and the general public. Avoid human-caused changes in predator populations. Requirement/Standard: Lessees/permittees shall prepare and implement a comprehensive waste management plan for all phases of exploration and development, including seismic activities. The plan shall be submitted to the authorized officer for approval, in consultation with federal, State, and North Slope Borough regulatory and resource agencies, as appropriate (based on agency legal authority and jurisdictional responsibility), as part of a plan of operations or other similar permit application. Management decisions affecting waste generation shall be addressed in the following order of priority: (1) prevention and reduction, (2) recycling, (3) treatment, and (4) disposal. The plan shall consider and take into account the following requirements: a. Methods to avoid attracting wildlife to food and garbage. The plan shall identify precautions that are to be taken to avoid attracting wildlife to food and garbage. b. Disposal of putrescible waste. Requirements prohibit the burial of garbage. Lessees and permitted users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the authorized officer. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility in accordance with EPA and Alaska Department of Environmental Conservation regulations and procedures. The burial of human waste is prohibited except as authorized by the authorized officer. c. Disposal of pumpable waste products. Except as specifically provided, the BLM requires that all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, Alaska Department of Environmental Conservation, and the Alaska Oil and Gas Conservation Commission regulations and procedures. On-pad temporary muds and cuttings storage, as approved by Alaska Department of Environmental Conservation, will be allowed as necessary to facilitate annular injection and/or backhaul operations. d. Disposal of wastewater and domestic wastewater. The BLM prohibits wastewater discharges or disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, unless authorized by a National Pollutant Discharge Elimination System or State permit.				contaminants, wildlife

A-8 Best Management Practice Objective: Minimize conflicts resulting from interaction between humans and bears during oil and gas activities. Requirement/Standard: Oil and gas lessees and their contractors and subcontractors will, as a part of preparation of lease operation planning, prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These plans shall include measures to: a. Minimize attraction of bears to the work sites. b. Organize layout of buildings and work sites to minimize human/bear interactions. c. Warn personnel of bears near or on work sites and identify proper procedures to be followed. d. Establish procedures, if authorized, to discourage bears from approaching the work site. e. Provide contingencies in the event bears do not leave the work site or cannot be discouraged by authorized personnel. f. Discuss proper storage and disposal of materials that may be toxic to bears. g. Provide a systematic record of bears on the work site and in the immediate area				wildlife, polar bears
WINTER OVERLAND MOVES AND SEISMIC WORK				
The following required operating procedures/best management practices apply to overland moves, seismic work, and any similar cross-country vehicle use of heavy equipment on non-roaded surfaces during the winter season. These restrictions do not apply to the use of such equipment on ice roads after they are constructed.				
C-1 Best Management Practice Objective: Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations. Requirement/Standard: a. Cross-country use of heavy equipment and seismic activity is prohibited within 0.5 mile of occupied grizzly bear dens identified by the Alaska Department of Fish and Game unless alternative protective measures are approved by the authorized officer in consultation with the Alaska Department of Fish and Game. b. Cross-country use of heavy equipment and seismic activity is prohibited within 1 mile of known or observed polar bear dens or seal birthing lairs. Operators near coastal areas shall conduct a survey for potential polar bear dens and seal birthing lairs and consult with the USFWS and/or NOAA Fisheries, as appropriate, before initiating activities in coastal habitat between October 30 and April 15.				polar bears, wildlife
FACILITY DESIGN AND CONSTRUCTION				

E-1 Best Management Practice Objective: Protect subsistence use and access to subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish and wildlife resources. Requirement/Standard: All roads must be designed, constructed, maintained, and operated to create minimal environmental impacts and to protect subsistence use and access to subsistence hunting and fishing areas. The authorized officer will consult with appropriate federal, State, and North Slope Borough regulatory and resources agencies prior to approving construction of roads. Subject to approval by the authorized officer, the construction, operation and maintenance of oil and gas field roads is the responsibility of the lessee unless the construction, operation, and maintenance of roads are assumed by the appropriate governing entity.	subsistence, wildlife
E-9 Best Management Practice Objective: Avoidance of human-caused increases in populations of predators of ground-nesting birds. Requirement/Standard: a. Lessee shall utilize best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee shall provide the authorized officer with an annual report on the use of oil and gas facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites. b. Feeding of wildlife is prohibited and will be subject to non-compliance regulations.	wildlife, birds
E-12 Best Management Practice Objective: Use ecological mapping as a tool to assess wildlife habitat before development of permanent facilities, to conserve important habitat types during development. Requirement/Standard: An ecological land classification map of the development area shall be developed before approval of facility construction. The map will integrate geomorphology, surface form, and vegetation at a scale, level of resolution, and level of positional accuracy adequate for detailed analysis of development alternatives. The map shall be prepared in time to plan one season of ground-based wildlife surveys, if deemed necessary by the authorized officer, before approval of the exact facility location and facility construction.	wildlife

E-19 Best Management Practice Objective: Provide information to be used in monitoring and assessing wildlife movements during and after construction. Requirement/Standard: A representation, in the form of ArcGIS-compatible shape-files, of all new infrastructure construction shall be provided to the authorized officer. During the planning and permitting phase, shape-files representing proposed locations shall be provided. Within 6 months of construction completion, shape-files (within GPS accuracy) of all new infrastructure shall be provided. Infrastructure includes all gravel roads and pads, facilities built on pads, pipelines and independently constructed powerlines (as opposed to those incorporated in pipeline design). Gravel pads shall be included as polygon feature. Roads, pipelines, and powerlines may be represented as line features but must include ancillary data to denote width, number pipes, etc. Poles for power lines may be represented as point features. Ancillary data shall include construction beginning and ending dates.				caribou, wildlife
USE OF AIRCRAFT FOR PERMITTED ACTIVITIES				

F-1 Best Management Practice Objective: Minimize the effects of low-flying aircraft on wildlife, subsistence activities, and local communities. Requirement/Standard: The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines (**Note:** This best management practice is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objectives of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.): a. Aircraft shall maintain an altitude of at least 1,500 feet above ground level when within 0.5 mile of cliffs identified as raptor nesting sites from April 15 through August 15 and within 0.5 mile of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from the BLM necessary to plan flight routes when routes may go near falcon nests. b. Aircraft shall maintain an altitude of at least 1,000 feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the authorized officer. The BLM will consult directly with the Alaska Department of Fish and Game in annually defining caribou winter ranges. c. Land user shall submit an aircraft use plan as part of an oil and gas exploration or development proposal. The plan shall address strategies to minimize impacts to subsistence hunting and associated activities, including but not limited to the number of flights, type of aircraft, and flight altitudes and routes, and shall also include a plan to monitor flights. Proposed aircraft use plans should be reviewed by appropriate federal, State, and borough agencies. Consultations with these same agencies will be required if unacceptable disturbance is identified by subsistence users. Adjustments, including possible suspension of all flights, may be required by the authorized officer if resulting disturbance is determined to be unacceptable. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered to allow larger aircraft to be employed, resulting in fewer flights to the facility. d. Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum.	subsistence, wildlife, Wilderness, recreation

Continued....F-1 Best Management Practice e. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Teshekpuk Lake Caribou Habitat Area (Maps 2-3K and 2-4K, depending upon alternative) from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. Aircraft use (including fixed wing and helicopter) by oil and gas lessees in the Goose Molting Area (Maps 2-3K or 2-4K) should be minimized from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. f. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Utukok River Uplands Special Area from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. (Note: The boundary of the Utukok River Uplands Special Area differs among Alternatives B-1 through D. See Maps 2-2, 2-3, and 2-4.) g. (Alternative B-2 only) Hazing of wildlife by aircraft is prohibited. Pursuit of running wildlife is hazing. If wildlife begins to run as an aircraft approaches, the aircraft is too close and must break away. h. (Alternative B-2 only) Fixed wing aircraft used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 2,000 feet and a 0.5-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. Helicopters used as part of a BLM- authorized activity along the coast shall maintain minimum altitude of 3,000 feet and a 1-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. i. (Alternative B-2 only) Aircraft used as part of a BLM-authorized activity along the coast and shore fast ice zone shall maintain minimum altitude of 3,000 feet and a buffer of 1 mile from aggregations of seals, unless doing so would endanger human life or violate safe flying practices.	subsistence, wildlife, Wilderness, recreation

I-1 Best Management Practice Objective: Minimize cultural and resource conflicts. Requirement/Standard: All personnel involved in oil and gas and related activities shall be provided information concerning applicable stipulations, best management practices, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. The lessee/permittee shall ensure that all personnel involved in permitted activities shall attend an orientation program at least once a year. The proposed orientation program shall be submitted to the authorized officer for review and approval and should: a. provide sufficient detail to notify personnel of applicable stipulations and best management practices as well as inform individuals working on the project of specific types of environmental, social, traditional and cultural concerns that relate to the region. b. Address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals, and provide guidance on how to avoid disturbance. c. Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species. d. Be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating. e. Include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation. f. Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low-flying aircraft. Of special concern is aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall caribou and moose hunting seasons, and flights near North Slope communities. g. Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site. h. Include on-site records of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee. i. Include a module discussing bear interaction plans to minimize conflicts between bears and humans. j. Provide a copy of 43 CFR 3163 regarding Non-Compliance Assessment and Penalties to on-site personnel. k. Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. This training should be offered to the North Slope Borough Health Department for review and comment. l. Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities. This training should be offered to the North Slope Borough Health Department for review and comment. (Same text as in Northeast NPR-A 2008 Record of Decision)			subsistence, cultural, wildlife
ENDANGERED SPECIES ACT—SECTION 7 CONSULTATION PROCESS			

J. The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that will contribute to the need to list such a species or their habitat. The BLM may require modifications to or disapprove a proposed activity 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 as amended, 16 USC § 1531 et seq., including completion of any required procedure for conference or consultation.	Wildlife, Vegetation, birds
SUMMER VEHICLE TUNDRA ACCESS	
L-1 Best Management Practice Objective: Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities. Requirement/Standard: On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Best management Practice C-2a. Permission for such use would only be granted after an applicant has: a. Submitted studies satisfactory to the authorized officer of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation. b. Submitted surveys satisfactory to the authorized officer of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.	wildlife, vegetation, water, birds

GENERAL WILDLIFE AND HABITAT PROTECTION				
M-1 Best Management Practice **NOTE**: **This best management practice is only applicable to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: Minimize disturbance and hindrance of wildlife, or alteration of wildlife movements through the NPR-A. Requirement/Standard: Chasing wildlife with ground vehicles is prohibited. Particular attention will be given to avoid disturbing caribou.				wildlife
M-4 Best Management Practice **NOTE**: **This best management practice is applicable only to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: Minimize loss of individuals of, and habitat for, mammalian species designated as Sensitive by the BLM in Alaska. Requirement/Standard: If a development is proposed in an area that provides potential habitat for the **Alaska tiny shrew**, the development proponent would conduct surveys at appropriate times of the year and in appropriate habitats in an effort to detect the presence of the shrew. The results of these surveys will be submitted to BLM with the application for development.				wildlife

FACILITY DESIGN AND CONSTRUCTION				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
E-20 Best Management Practice **NOTE**: **This best management practice is only applicable to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: Manage permitted activities to meet Visual Resource Management class objectives described below. **Class I:** Natural ecological changes and very limited management activity are allowed. The level of change to the characteristic landscape should be very low and must not attract attention. **Class II:** The level of change to the characteristic landscape should be low. Management activities may be seen, but should not dominate the view of the casual observer. Any changes should repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. **Class III:** The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. **Class IV:** The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize impacts through location and design by repeating form, line, color, and texture. Requirement/Standard: At the time of application for construction of permanent facilities, the lessee/permittee shall, after consultation with the authorized officer, submit a plan to best minimize visual impacts, consistent with the Visual Resource Management class for the lands on which facilities would be located. A photo simulation of the proposed facilities may be a necessary element of the plan.				Wilderness, recreation
USE OF AIRCRAFT FOR PERMITTED ACTIVITIES				

F-1 Best Management Practice Objective: Minimize the effects of low-flying aircraft on wildlife, subsistence activities, and local communities. Requirement/Standard: The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines (**Note:** This best management practice is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objectives of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.): a. Aircraft shall maintain an altitude of at least 1,500 feet above ground level when within 0.5 mile of cliffs identified as raptor nesting sites from April 15 through August 15 and within 0.5 mile of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from the BLM necessary to plan flight routes when routes may go near falcon nests. b. Aircraft shall maintain an altitude of at least 1,000 feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the authorized officer. The BLM will consult directly with the Alaska Department of Fish and Game in annually defining caribou winter ranges. c. Land user shall submit an aircraft use plan as part of an oil and gas exploration or development proposal. The plan shall address strategies to minimize impacts to subsistence hunting and associated activities, including but not limited to the number of flights, type of aircraft, and flight altitudes and routes, and shall also include a plan to monitor flights. Proposed aircraft use plans should be reviewed by appropriate federal, State, and borough agencies. Consultations with these same agencies will be required if unacceptable disturbance is identified by subsistence users. Adjustments, including possible suspension of all flights, may be required by the authorized officer if resulting disturbance is determined to be unacceptable. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered to allow larger aircraft to be employed, resulting in fewer flights to the facility. d. Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum.	subsistence, wildlife, Wilderness, recreation

Continued....F-1 Best Management Practice e. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Teshekpuk Lake Caribou Habitat Area (Maps 2-3K and 2-4K, depending upon alternative) from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. Aircraft use (including fixed wing and helicopter) by oil and gas lessees in the Goose Molting Area (Maps 2-3K or 2-4K) should be minimized from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. f. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Utukok River Uplands Special Area from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. (Note: The boundary of the Utukok River Uplands Special Area differs among Alternatives B-1 through D. See Maps 2-2, 2-3, and 2-4.) g. (Alternative B-2 only) Hazing of wildlife by aircraft is prohibited. Pursuit of running wildlife is hazing. If wildlife begins to run as an aircraft approaches, the aircraft is too close and must break away. h. (Alternative B-2 only) Fixed wing aircraft used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 2,000 feet and a 0.5-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. Helicopters used as part of a BLM- authorized activity along the coast shall maintain minimum altitude of 3,000 feet and a 1-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. i. (Alternative B-2 only) Aircraft used as part of a BLM-authorized activity along the coast and shore fast ice zone shall maintain minimum altitude of 3,000 feet and a buffer of 1 mile from aggregations of seals, unless doing so would endanger human life or violate safe flying practices.	subsistence, wildlife, Wilderness, recreation

WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
A-11 Best Management Practice Objective: Ensure that permitted activities do not create human health risks through contamination of subsistence foods. Requirement/Standard: A lessee proposing a permanent oil and gas development shall design and implement a monitoring study of contaminants in locally-used subsistence foods. The monitoring study shall examine subsistence foods for all contaminants that could be associated with the proposed development. The study shall identify the level of contaminants in subsistence foods prior to the proposed permanent oil and gas development and monitor the level of these contaminants throughout the operation and abandonment phases of the development. If ongoing monitoring detects a measurable and persistent increase in a contaminant in subsistence foods, the lessee shall design and implement a study to determine how much, if any, of the increase in the contaminant in subsistence foods originates from the lessee's activities. If the study determines that a portion of the increase in contamination in subsistence foods is caused by the lessee's activities, the authorized officer may require changes in the lessee's processes to reduce or eliminate emissions of the contaminant. The design of the study/studies must meet the approval of the authorized officer. The authorized officer may consult with appropriate federal, State, and North Slope Borough agencies prior to approving the study/studies design. The authorized officer may require/authorize changes in the design of the studies throughout the operations and abandonment period, or terminate or suspend studies if results warrant.				contaminants, subsistence
A-12 Best Management Practice **NOTE**: **This best management practice is applicable only to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: To minimize negative health impacts associated with oil spills. Requirement/Standard: If an oil spill with potential impacts to public health occurs, the BLM, in undertaking its oil spill responsibilities, will consider: a. Immediate health impacts and responses for affected communities and individuals. b. Long-term monitoring for contamination of subsistence food sources. c. Long-term monitoring of potential human health impacts. d. Perceptions of contamination and subsequent changes in consumption patterns. e. Health promotion activities and communication strategies to maintain the consumption of traditional food.				contaminants, subsistence
FACILITY DESIGN AND CONSTRUCTION				

E-1 Best Management Practice Objective: Protect subsistence use and access to subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish and wildlife resources. Requirement/Standard: All roads must be designed, constructed, maintained, and operated to create minimal environmental impacts and to protect subsistence use and access to subsistence hunting and fishing areas. The authorized officer will consult with appropriate federal, State, and North Slope Borough regulatory and resources agencies prior to approving construction of roads. Subject to approval by the authorized officer, the construction, operation and maintenance of oil and gas field roads is the responsibility of the lessee unless the construction, operation, and maintenance of roads are assumed by the appropriate governing entity.				subsistence, wildlife
E-3 Lease Stipulation Objective: Maintain free passage of marine and anadromous fish and protect subsistence use and access to subsistence hunting and fishing. Requirement/Standard: Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas. Causeways, docks, artificial islands, and bottom-founded drilling structures shall be designed to ensure free passage of marine and anadromous fish and to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics. A monitoring program, developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies, shall be required to address the objectives of water quality and free passage of fish.				fish, subsistence
E-13 Best Management Practice Objective: Protect cultural and paleontological resources. Requirement/Standard: Lessees shall conduct a cultural and paleontological resources survey prior to any ground-disturbing activity. Upon finding any potential cultural or paleontological resource, the lessee or their designated representative shall notify the authorized officer and suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer.				cultural
USE OF AIRCRAFT FOR PERMITTED ACTIVITIES				

F-1 Best Management Practice Objective: Minimize the effects of low-flying aircraft on wildlife, subsistence activities, and local communities. Requirement/Standard: The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines (**Note:** This best management practice is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objectives of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.): a. Aircraft shall maintain an altitude of at least 1,500 feet above ground level when within 0.5 mile of cliffs identified as raptor nesting sites from April 15 through August 15 and within 0.5 mile of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from the BLM necessary to plan flight routes when routes may go near falcon nests. b. Aircraft shall maintain an altitude of at least 1,000 feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the authorized officer. The BLM will consult directly with the Alaska Department of Fish and Game in annually defining caribou winter ranges. c. Land user shall submit an aircraft use plan as part of an oil and gas exploration or development proposal. The plan shall address strategies to minimize impacts to subsistence hunting and associated activities, including but not limited to the number of flights, type of aircraft, and flight altitudes and routes, and shall also include a plan to monitor flights. Proposed aircraft use plans should be reviewed by appropriate federal, State, and borough agencies. Consultations with these same agencies will be required if unacceptable disturbance is identified by subsistence users. Adjustments, including possible suspension of all flights, may be required by the authorized officer if resulting disturbance is determined to be unacceptable. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered to allow larger aircraft to be employed, resulting in fewer flights to the facility. d. Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum.	subsistence, wildlife, Wilderness, recreation

Continued....F-1 Best Management Practice e. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Teshekpuk Lake Caribou Habitat Area (Maps 2-3K and 2-4K, depending upon alternative) from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. Aircraft use (including fixed wing and helicopter) by oil and gas lessees in the Goose Molting Area (Maps 2-3K or 2-4K) should be minimized from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. f. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Utukok River Uplands Special Area from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. (Note: The boundary of the Utukok River Uplands Special Area differs among Alternatives B-1 through D. See Maps 2-2, 2-3, and 2-4.) g. (Alternative B-2 only) Hazing of wildlife by aircraft is prohibited. Pursuit of running wildlife is hazing. If wildlife begins to run as an aircraft approaches, the aircraft is too close and must break away. h. (Alternative B-2 only) Fixed wing aircraft used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 2,000 feet and a 0.5-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. Helicopters used as part of a BLM- authorized activity along the coast shall maintain minimum altitude of 3,000 feet and a 1-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. i. (Alternative B-2 only) Aircraft used as part of a BLM-authorized activity along the coast and shore fast ice zone shall maintain minimum altitude of 3,000 feet and a buffer of 1 mile from aggregations of seals, unless doing so would endanger human life or violate safe flying practices.			subsistence, wildlife, Wilderness, recreation
SUBSISTENCE CONSULTATION FOR PERMITTED ACTIVITIES			

H-1 Best Management Practice Objective: Provide opportunities for participation in planning and decision making to prevent unreasonable conflicts between subsistence uses and other activities. Requirement/Standard: Lessee/permittee shall consult directly with affected communities using the following guidelines: a. Before submitting an application to the BLM, the applicant shall consult with directly affected subsistence communities, the North Slope Borough, and the National Petroleum Reserve-Alaska Subsistence Advisory Panel to discuss the siting, timing and methods of their proposed operations to help discover local traditional and scientific knowledge, resulting in measures that minimize impacts to subsistence uses. Through this consultation, the applicant shall make every reasonable effort, including such mechanisms as conflict avoidance agreements and mitigating measures, to ensure that proposed activities will not result in unreasonable interference with subsistence activities. In the event that no agreement is reached between the parties, the authorized officer shall consult with the directly involved parties and determine which activities will occur, including the timeframes. b. The applicant shall submit documentation of consultation efforts as part of its operations plan. Applicants should submit the proposed plan of operations to the National Petroleum Reserve-Alaska Subsistence Advisory Panel for review and comment. The applicant must allow time for the BLM to conduct formal government-to-government consultation with Native Tribal governments if the proposed action requires it. c. A plan shall be developed that shows how the activity, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. The plan will also describe the methods used to monitor the effects of the activity on subsistence use. The plan shall be submitted to the BLM as part of the plan of operations. The plan should address the following items: 1. A detailed description of the activity(ies) to take place (including the use of aircraft). 2. A description of how the lessee/permittee will minimize and/or deal with any potential impacts identified by the authorized officer during the consultation process. 3. A detailed description of the monitoring effort to take place, including process, procedures, personnel involved and points of contact both at the work site and in the local community. 4. Communication elements to provide information on how the applicant will keep potentially affected individuals and communities up-to-date on the progress of the activities and locations of possible, short-term conflicts (if any) with subsistence activities. Communication methods could include holding community meetings, open house meetings, workshops, newsletters, radio and television announcements, etc.	subsistence

Continued.....H-1 Best Management Practice 5. Procedures necessary to facilitate access by subsistence users to conduct their activities. 6. (Alternative B-2 only) Barge operators requiring a BLM permit are required to demonstrate that barging activities will not have unmitigable adverse impacts on the availability of marine mammals to subsistence hunters. 7. (Alternative B-2 only) All vessels over 50 ft. in length engaged in operations requiring a BLM permit must have an Automatic Identification System (AIS) transponder system on the vessel. d. During development, monitoring plans must be established for new permanent facilities, including pipelines, to assess an appropriate range of potential effects on resources and subsistence as determined on a case-by-case basis given the nature and location of the facilities. The scope, intensity, and duration of such plans will be established in consultation with the authorized officer and NPR-A Subsistence Advisory Panel. e. Permittees that propose barging facilities, equipment, supplies, or other materials to NPR-A in support of oil and gas activities in the NPR-A shall notify, confer, and coordinate with the Alaska Eskimo Whaling Commission, the appropriate local community whaling captains' associations, and the North Slope Borough to minimize impacts from the proposed barging on subsistence whaling activities.	subsistence

H-2 Best Management Practice Objective: Prevent unreasonable conflicts between subsistence activities and geophysical (seismic) exploration. Requirement/Standard: In addition to the consultation process described in Best Management Practice H-1 for permitted activities, before activity to conduct geophysical (seismic) exploration commences, applicants shall notify the local search and rescue organizations of proposed seismic survey locations for that operational season. For the purpose of this standard, a potentially affected cabin/campsite is defined as any camp or campsite used for subsistence purposes and located within the boundary of the area subject to proposed geophysical exploration and/or within 1 mile of actual or planned travel routes used to supply the seismic operations while it is in operation. a. Because of the large land area covered by typical geophysical operations and the potential to impact a large number of subsistence users during the exploration season, the permittee/operator will notify all potentially affected subsistence-use cabin and campsite users. b. The official recognized list of subsistence-use cabin and campsite users is the North Slope Borough's most current inventory of cabins and campsites, which have been identified by the subsistence users' names. c. A copy of the notification letter, a map of the proposed exploration area, and the list of potentially affected users shall also be provided to the office of the appropriate Native Tribal government. d. The authorized officer will prohibit seismic work within 1 mile of any known subsistence-use cabin or campsite unless an alternate agreement between the cabin/campsite owner/user is reached through the consultation process and presented to the authorized officer. (Regardless of the consultation outcome, the authorized officer will prohibit seismic work within 300 feet of a known subsistence-use cabin or campsite.) e. The permittee shall notify the appropriate local search and rescue (e.g., Nuiqsut Search and Rescue, Atqasuk Search and Rescue) of their current operational location within the NPR-A on a weekly basis. This notification should include a map indicating the current extent of surface use and occupation, as well as areas previously used/occupied during the course of the operation in progress. The purpose of this notification is to allow hunters up-to-date information regarding where seismic exploration is occurring, and has occurred, so that they can plan their hunting trips and access routes accordingly. Identification of the appropriate search and rescue offices to be contacted can be	subsistence
H-3 Best Management Practice Objective: Minimize impacts to sport hunting and trapping species and to subsistence harvest of those animals. Requirement/Standard: Hunting and trapping by lessee's/permittee' s employees, agents, and contractors are prohibited when persons are on "work status." Work status is defined as the period during which an individual is under the control and supervision of an employer. Work status is terminated when the individual's shift ends and he/she returns to a public airport or community (e.g., Fairbanks, Barrow, Nuiqsut, or Deadhorse). Use of lessee/permittee facilities, equipment, or transport for personnel access or aid in hunting and trapping is prohibited.	subsistence

I-1 Best Management Practice Objective: Minimize cultural and resource conflicts. Requirement/Standard: All personnel involved in oil and gas and related activities shall be provided information concerning applicable stipulations, best management practices, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. The lessee/permittee shall ensure that all personnel involved in permitted activities shall attend an orientation program at least once a year. The proposed orientation program shall be submitted to the authorized officer for review and approval and should: a. provide sufficient detail to notify personnel of applicable stipulations and best management practices as well as inform individuals working on the project of specific types of environmental, social, traditional and cultural concerns that relate to the region. b. Address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals, and provide guidance on how to avoid disturbance. c. Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species. d. Be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating. e. Include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation. f. Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low-flying aircraft. Of special concern is aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall caribou and moose hunting seasons, and flights near North Slope communities. g. Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site. h. Include on-site records of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee. i. Include a module discussing bear interaction plans to minimize conflicts between bears and humans. j. Provide a copy of 43 CFR 3163 regarding Non-Compliance Assessment and Penalties to on-site personnel. k. Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. This training should be offered to the North Slope Borough Health Department for review and comment. l. Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities. This training should be offered to the North Slope Borough Health Department for review and comment. (Same text as in Northeast NPR-A 2008 Record of Decision)	subsistence, cultural, wildlife

WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
A-9 Best Management Practice Objective: Reduce air quality impacts. Requirement/Standard: All oil and gas operations (vehicles and equipment) that burn diesel fuels must use "ultra-low sulfur" diesel as defined by the Alaska Department of Environmental Conservation-Division of Air Quality.				Air Quality
A-10 Best Management Practice Objective: Prevent unnecessary or undue degradation of the lands and protect health. Requirement/Standard: This measure includes the following elements: a. Prior to initiation of a NEPA analysis for an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source (hereafter project), the authorizing officer (BLM) may require the project proponent to provide a minimum of one year of baseline ambient air monitoring data for any pollutant(s) of concern as determined by BLM if no representative air monitoring data are available for the project area, or existing representative ambient air monitoring data are insufficient, incomplete, or do not meet minimum air monitoring standards set by the Alaska DEC or the EPA. If BLM determines that baseline monitoring is required, this pre-analysis data must meet Alaska DEC and EPA air monitoring standards, and cover the year immediately prior to the submittal. Pre-project monitoring may not be appropriate where the life of the project is less than one year. b. The BLM may require monitoring for the life of the project depending on the magnitude of potential air emissions from the project, proximity to a federally mandated Class I area, sensitive Class II area (as identified on a case-by-case basis by Alaska DEC or a federal land management agency), or population center, location within or proximity to a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during NEPA undertaken for the project. c. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the project proponent shall prepare (and submit for BLM approval) an emissions inventory that includes quantified emissions of regulated air pollutants from all direct and indirect sources related to the proposed project, including reasonably foreseeable air pollutant emissions of criteria air pollutants, volatile organic compounds, hazardous air pollutants, and greenhouse gases estimated for each year for the life of the project. The BLM will use this estimated emissions inventory to identify pollutants of concern and to determine the appropriate level of air analysis to be conducted for the proposed project.				Air Quality

Continued....A-10 Best Management Practice d. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the BLM may require the proponent to provide an emissions reduction plan that includes a detailed description of operator committed measures to reduce project related air pollutant emissions including, but not limited to greenhouse gases and fugitive dust. e. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the authorized officer may require air quality modeling for purposes of analyzing project direct, indirect or cumulative impacts to air quality. The BLM may require air quality modeling depending on the magnitude of potential air emissions from the project or activity, duration of the proposed action, proximity to a federally mandated Class I area, sensitive Class II area (as identified on a case-by-case basis by Alaska DEC or a federal land management agency), or population center, location within a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during NEPA undertaken for the project. The BLM will determine the information required for a project specific modeling analysis through the development of a modeling protocol for each analysis. The authorized officer will consult with appropriate federal, State, and/or local agencies regarding modeling to inform his/her modeling decision and avoid duplication of effort. The modeling shall compare predicted impacts to all applicable local, State, and federal air quality standards and increments, as well as other scientifically defensible significance thresholds (such as impacts to air quality related values, incremental cancer risks, etc.). f. The BLM may require air quality mitigation measures and strategies within its authority (and in consultation with local, state, federal, and tribal agencies with responsibility for managing air resources) in addition to regulatory requirements and proponent committed emission reduction measures, and for emission sources not otherwise regulated by Alaska DEC or EPA, if the air quality analysis shows potential future impacts to NAAQS or AAAQS or impacts above specific levels of concern for air quality related values (AQRVs). g. If ambient air monitoring indicates that project-related emissions are causing or contributing to impacts that would cause unnecessary or undue degradation of the lands, cause exceedances of NAAQS, or fail to protect health (either directly or through use of subsistence resources), the authorized officer may require changes in activities at any time to reduce these emissions to comply with the NAAQS and/or minimize impacts to AQRVs. Within the scope of BLM's authority, the BLM may require additional emission control strategies to minimize or reduce impacts to air quality. h. (**Alternative B-2 only**) Publicly available reports on air quality baseline monitoring, emissions inventory, and modeling results developed in conformance with this best management procedure shall be provided by the project proponent to the North Slope Borough and to local communities and tribes in a timely manner.	
Continued....A-10 Best Management Practice h. (**Alternative B-2 only**) Publicly available reports on air quality baseline monitoring, emissions inventory, and modeling results developed in conformance with this best management procedure shall be provided by the project proponent to the North Slope Borough and to local communities and tribes in a timely manner.	

Alternative B-1	Alternative B-2 Preferred Alternative	Alternative C	Alternative D	FWS Category
A-1 Best Management Practice Objective: Protect the health and safety of oil and gas field workers and the general public by disposing of solid waste and garbage in accordance with applicable federal, State, and local law and regulations. Requirement/Standard: Areas of operation shall be left clean of all debris.				contaminants
A-2 Best Management Practice Objective: Minimize impacts on the environment from non-hazardous and hazardous waste generation. Encourage continuous environmental improvement. Protect the health and safety of oil and gas field workers and the general public. Avoid human-caused changes in predator populations. Requirement/Standard: Lessees/permittees shall prepare and implement a comprehensive waste management plan for all phases of exploration and development, including seismic activities. The plan shall be submitted to the authorized officer for approval, in consultation with federal, State, and North Slope Borough regulatory and resource agencies, as appropriate (based on agency legal authority and jurisdictional responsibility), as part of a plan of operations or other similar permit application. Management decisions affecting waste generation shall be addressed in the following order of priority: (1) prevention and reduction, (2) recycling, (3) treatment, and (4) disposal. The plan shall consider and take into account the following requirements: a. Methods to avoid attracting wildlife to food and garbage. The plan shall identify precautions that are to be taken to avoid attracting wildlife to food and garbage. b. Disposal of putrescible waste. Requirements prohibit the burial of garbage. Lessees and permitted users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the authorized officer. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility in accordance with EPA and Alaska Department of Environmental Conservation regulations and procedures. The burial of human waste is prohibited except as authorized by the authorized officer. c. Disposal of pumpable waste products. Except as specifically provided, the BLM requires that all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, Alaska Department of Environmental Conservation, and the Alaska Oil and Gas Conservation Commission regulations and procedures. On-pad temporary muds and cuttings storage, as approved by Alaska Department of Environmental Conservation, will be allowed as necessary to facilitate annular injection and/or backhaul operations. d. Disposal of wastewater and domestic wastewater. The BLM prohibits wastewater discharges or disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, unless authorized by a National Pollutant Discharge Elimination System or State permit.			contaminants, wildlife

OIL AND GAS EXPLORATORY DRILLING				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
D-2 Lease Stipulation Objective: Minimize surface impacts from exploratory drilling. Requirement/Standard: Construction of permanent or gravel oil and gas facilities shall be prohibited for exploratory drilling. Use of a previously constructed road or pad may be permitted if it is environmentally preferred.				operations
FACILITY DESIGN AND CONSTRUCTION				
E-4 Best Management Practice Objective: Minimize the potential for pipeline leaks, the resulting environmental damage, and industrial accidents. Requirement/Standard: All pipelines shall be designed, constructed, and operated under an authorized officer-approved quality assurance/quality control plan that is specific to the product transported and shall be constructed to accommodate the best available technology for detecting and preventing corrosion or mechanical defects during routine structural integrity inspections.				operations
E-5 Best Management Practice Objective: Minimize impacts of the development footprint. Requirement/Standard: Facilities shall be designed and located to minimize the development footprint. Issues and methods that are to be considered include: (a) use of maximum extended-reach drilling for production drilling to minimize the number of pads and the network of roads between pads; (b) sharing facilities with existing development; (c) collocation of all oil and gas facilities, except airstrips, docks, and seawater-treatment plants, with drill pads; (d) integration of airstrips with roads; (e) use of gravel- reduction technologies, e.g., insulated or pile-supported pads, (f) coordination of facilities with infrastructure in support of offshore development. **Note**: Where aircraft traffic is a concern, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.				operations

FACILITY DESIGN AND CONSTRUCTION					
Alternative B-1	**Alternative B-2 Preferred Alternative**		**Alternative C**	**Alternative D**	FWS Category
E-8 Best Management Practice Objective: Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources. Requirement/Standard: Gravel mine site design and reclamation will be in accordance with a plan approved by the authorized officer. The plan shall be developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies and consider: a. Locations outside the active floodplain. b. Design and construction of gravel mine sites within active floodplains to serve as water reservoirs for future use. c. Potential use of the site for enhancing fish and wildlife habitat. d. Potential storage and reuse of sod/overburden for the mine site or at other disturbed sites on the North Slope.					water, reclamation
OIL AND GAS FIELD ABANDONMENT					
G-1 Lease Stipulation Objective: Ensure long-term reclamation of land to its previous condition and use. Requirement/Standard: Prior to final abandonment, land used for oil and gas infrastructure—including but not limited to well pads, production facilities, access roads, and airstrips—shall be reclaimed to ensure eventual restoration of ecosystem function. The leaseholder shall develop and implement an abandonment and reclamation plan approved by the BLM. The plan shall describe short-term stability, visual, hydrological, and productivity objectives and steps to be taken to ensure eventual ecosystem restoration to the land's previous hydrological, vegetative, and habitat condition. The BLM may grant exceptions to satisfy stated environmental or public purposes.					reclamation

Agenda

USFWS

Internal Alternatives Workshop for the Arctic Refuge Coastal Plain Leasing EIS

June 19-20
830 am -4:30 pm

Refuges Conference Room, 2nd Floor, 101 12th Ave Fairbanks, AK

or by both Vidyo: R7_Fairbanks_Refuges_Conf_Room

and phone (mute Vidyo): b5-conf [redacted]

Objectives

- Identify sensitive resources and uses in the Arctic Refuge, and ways to minimize impacts through EIS Alternatives based on availability for leasing, Stipulations and Best Management Practices (BMPs)
- Evaluate BMPs that guide operations to protect environment, subsistence and other values

Tuesday June 19th

Time	*Item*
8:30-10:15am	**Welcome – Meghan Holton, Facilitator** - Introductions - Meeting opening by Greg Siekaniec - Intro to NPRA Alternatives by Wendy Loya - Workshop approach to alternatives development
10:15-10:30am	**Break**
10:30 -11:30	**Water Resources and Fish/Aquatic Communities** - Overview of relevant existing data, ID important missing data - Identify Stipulations (Stips) and Best Management Practices (BMPs) to protect river corridors (including Eligible Wild and Scenic Rivers), Lakes, fish habitat, springs, aufeis
11:30-12:00	**Vegetation, Soils, Permafrost, Snow** - Overview of relevant existing data, ID important missing data - Identify Stipulations and BMPs to protect terrestrial resources and regulate winter tundra travel - Unique landscape features
12:00–1:30pm	**Lunch**
1:30-2:15	**Caribou** - Overview of relevant existing data, ID important missing data - Identify Stipulations and BMPs to protect important caribou seasonal habitats

2:15-3:15	**Polar Bears** - Overview of relevant existing data, ID important missing data - Identify Stipulations and BMPs consistent with MMPA/ESA permitting conditions
3:15-3:30pm	**Break**
3:15-3:45 pm	**Migratory Birds** - Overview of relevant existing data, ID important missing data - Identify Stipulations and BMPs to protect important bird habitats
3:45 -4:15	**Other Mammals** - Overview of relevant existing data, ID important missing data - Identify Stipulations and BMPs to protect other wildlife species & TES
4:15 -4:30	**Summary** - Identify unresolved issues needed to tackle Wednesday or before BLM workshop - ADJOURN!
6:00	**Meet for Group Dinner** - Chena Pump House 796 Chena Pump Road - Reservation under Wendy Loya (18 people)

Wednesday June 20

Time	***Item***
8:30-8:35am	**Welcome – Meghan Holton, Facilitator** - Recap meeting rules
8:35-9:15am	**Wilderness** - ID criteria and data to support protection of Wilderness Values on Coastal Plain and adjacent Mollie Beattie Wilderness - Identify Stipulations and BMPs to protect Wilderness Values, including overlap with those identified on Tuesday
9:15-9:45	**Visitor Use (Hunting/Recreation/Other)** - Overview of data of relevant existing data, ID important missing data - Identify Stipulations and BMPs to protect Visitor Use experience
9:45-10:00 am	**Break**
10:00-11:00	**BLM: Coastal Plain Oil & Gas Leasing Program EIS: Affected Environment Kick-off** - Break from our Internal Workshop to join BLM and EMPSi conference call - No further agenda has been provided - b5-conf Passcode: b5-conf

11:00-12:00	**Subsistence, Cultural, Anthropological, Archaeological** - Overview of relevant existing data, ID important missing data - Identify Stipulations and BMPs to protect subsistence use, resources we have not yet covered (e.g. marine mammals) - Cultural resource protection - Use of Aircraft for Permitted Activities - Subsistence Consultation and Orientation for Permitted Activities
12:00–1:30pm	**Lunch**
1:30-2:00pm	**Air Quality & Contaminants** - Overview of relevant existing data, ID important missing data - Identify Stipulations and BMPs to monitor and protect air quality
2:00-3:00pm	**Operations & Infrastructure** - Infrastructure and its impacts
3:00-3:15pm	**Break**
3:15–3:45pm	**Abandonment and Reclamation** - Essential stipulation(s) to ensure long-term reclamation of land to its previous condition and use.
3:45-4:30	**Wrap-up and action items** - Make sure "Parking Lot" is empty (all issues have been cleared or are on Action list) - Go over action items and make sure tasks are assigned ☺ - Adjourn. Thank you all!

From: Wendy Loya
To: Paul Leonard; John Trawicki; Randy Brown; Doug Damberg; Jennifer Reed; Joanna Fox; Hollis Twitchell; Drew Crane; Lynnda Kahn; Angela Matz; Christopher Latty; Patrick O"Dell; Carl Johnson; Mitch Ellis; Stephen Arthur; Steve Berendzen; Joshua Ream; Eric Taylor; Catherine Collins; Socheata Lor; Roger Kaye; Edward Decleva; Tim Allen; Ryan Wilson; Joshua Rose; Christopher Putnam; Kevin Doherty; Todd Hopkins; Tracy Fischbach; Karen Clark; Greg Siekaniec; Bud Cribley; Agnew Beck; Sara Boario; Mary Colligan
Subject: Updated Webinar info: FWS Workshop on Alternatives for Coastal Plain Leasing EIS/Seismic EA 6/19-20
Date: Monday, June 18, 2018 5:55:39 PM

NEW Webinar info if you are joining remotely (we cannot use Vidyo with ArcGIS Pro). If you don't have MyMeetings software downloaded, look for the link to RUN A TEMPORARY APPLICATION. That typically works just as well.

1. Join the meeting: b5 - conf [redacted]
2. Enter the required fields.
3. Indicate that you have read the Privacy Policy.
4. Click on Proceed.

Same phone: b5 - conf [redacted]

And the countdown is on….
See you tomorrow,
Wendy

Dr. Wendy M. Loya,
Arctic Program Coordinator
Office of Science Applications, US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

From: Wendy Loya [mailto:wendy_loya@fws.gov]
Sent: Sunday, June 17, 2018 5:19 PM
To: Paul Leonard <paul_leonard@fws.gov>; John Trawicki <john_trawicki@fws.gov>; Randy Brown <randy_j_brown@fws.gov>; Doug Damberg <doug_damberg@fws.gov>; Jennifer Reed <jennifer_reed@fws.gov>; Joanna Fox <joanna_fox@fws.gov>; Hollis Twitchell <hollis_twitchell@fws.gov>; Drew Crane <drew_crane@fws.gov>; Lynnda Kahn <lynnda_kahn@fws.gov>; Angela Matz <angela_matz@fws.gov>; Christopher Latty <christopher_latty@fws.gov>; Patrick O'Dell <patrick_odell@fws.gov>; Carl Johnson <carl_johnson@fws.gov>; Mitch Ellis <mitch_ellis@fws.gov>; Stephen Arthur <stephen_arthur@fws.gov>; Steve Berendzen <steve_berendzen@fws.gov>; Joshua Ream <joshua_ream@fws.gov>; Eric Taylor <eric_taylor@fws.gov>; Catherine Collins <catherine_collins@fws.gov>; Socheata Lor <socheata_lor@fws.gov>; Roger Kaye <roger_kaye@fws.gov>; Edward Decleva <edward_decleva@fws.gov>; Tim Allen <tim_allen@fws.gov>; Ryan Wilson <ryan_r_wilson@fws.gov>; Joshua Rose <joshua_rose@fws.gov>; Christopher Putnam <christopher_putnam@fws.gov>; Kevin Doherty <kevin_doherty@fws.gov>; Todd Hopkins <todd_hopkins@fws.gov>; Tracy Fischbach

<tracy_fischbach@fws.gov>; Karen Clark <karen_clark@fws.gov>; Greg Siekaniec <greg_siekaniec@fws.gov>; Bud Cribley (bud_cribley@fws.gov) <bud_cribley@fws.gov>; 'Agnew Beck' <meghan@agnewbeck.com>; Sara Boario <sara_boario@fws.gov>; Mary Colligan <mary_colligan@fws.gov>
Subject: Agenda for FWS Workshop on Alternatives for Coastal Plain Leasing EIS/Seismic EA 6/19-20

Dear FWS "1002" team,

Attached is the agenda for the FWS Internal Alternatives Workshop for the Arctic Refuge Coastal Plain Leasing EIS. I am excited to have so many of our staff experts join us in Fairbanks; we will meet in the Refuges Conference room on the 2nd floor of the Fairbanks Field Office/Federal Building downtown. Greg Siekaniec will be opening the workshop at 8:30am on Tuesday, and we hope to be done by 4:30pm both days. We are happy to have Meghan Holtan from Agnew Beck as our facilitator.

The workshop will focus on the spatial component of developing alternatives for the Arctic Refuge Coastal Plain, including availability of lands for leasing and stipulations/best management practices (BMPs) that would protect sensitive resources. There are many BMPs that are used to protect resources that we won't have time to discuss as a group, but which we will solicit feedback on between June 21-July 6th, prior to the BLM Alternatives workshop. You can see all of the NPRA Stipulations and BMPs in the attached excel workbook which organizes the NPRA Final IAP/EIS Table 2.3 by the topics. I will have copies on hand at the workshop.

FYI, we will join the BLM/EMPSi-hosted "Coastal Plain Leasing EIS Affected Environment Kick-off" on Weds at 10am.

A few logistical notes:

Please take the elevator when you come in the North side main entrance and go to 2nd floor. You will get locked in stairwells unless your PIV card is active for the Fairbanks Field Office building.

A few who can't attend can connect via Vidyo and phone, see the agenda for connection info.

I have made a reservation for the group to go to dinner at Chena Pump House Tuesday evening at 6pm. We will have plenty of vehicles to shuttle those that don't have transportation.

If you have indicated you are not able to attend… don't fret, we'll continue to gather information and feedback until the BLM-hosted workshop on July 9th.

Thank you, and see you soon! Don't hesitate to contact me with any questions,
Wendy

Dr. Wendy M. Loya,
Arctic Program Coordinator

Office of Science Applications, US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

From: Todd Hopkins
To: Wendy Loya
Cc: hollis_twitchell@fws.gov
Subject: DOI priorities and 1002
Date: Wednesday, June 20, 2018 1:52:25 PM

Wendy,

Below are the administrations top 10 priorities. I mentioned the one about tribal sovereignty regarding our discussions on subsistence use/access today.

Todd

The Secretary of the Interior's Top Ten Priorities
1. Creating a conservation stewardship legacy second only to Teddy Roosevelt
a. Utilize science to identify best practices to manage land and water resources and
adapt to changes in the environment;
b. Examine land use planning processes and land use designations that govern public
use and access;
c. Revise and streamline the environmental and regulatory review process while maintaining environmental standards.
d. Review DOI water storage, transportation, and distribution systems to identify
opportunities to resolve conflicts and expand capacity;
e. Foster relationships with conservation organizations advocating for balanced stewardship and use of public lands;
f. Identify and implement initiatives to expand access to DOI lands for hunting and
fishing;
g. Shift the balance towards providing greater public access to public lands over
restrictions to access.
2. Utilizing our natural resources
a. Ensure American Energy is available to meet our security and economic needs; b. Ensure access to mineral resources, especially the critical and rare earth minerals
needed for scientific, technological, or military applications;
c. Refocus timber programs to embrace the entire 'healthy forests' lifecycle; d. Manage competition for grazing resources.
3. Restoring trust with local communities
a. Be a better neighbor with those closest to our resources by improving dialogue and
relationships with persons and entities bordering our lands;
b. Expand the lines of communication with Governors, state natural resource offices,
Fish and Wildlife offices, water authorities, county commissioners, Tribes, and local communities.
4. Ensuring sovereignty means something
a. Support tribal self-determination, self-governance, and sovereignty;
b. Solidify mutual interests between the U.S. and the freely associated states and

territories.
5. Generating additional revenues to support DOI & National interests
a. Ensure that the public receives the full market value for the
natural resources
produced on federal lands;
b. Ensure that fees or costs levied for DOI services are reasonable
and targeted to
achieve cost recovery;

c. Consider the impact of DOI decisions on economic development and
job creation.
6. Protecting our people and the border
a. Actively support efforts to secure our southern border;
b. Ensure DOI law enforcement staffing addresses public safety risks
anticipated on
DOI land.
c. Promote a "public service" demeanor within our law enforcement community.
7. Striking a regulatory balance
a. Reduce the administrative and regulatory burden imposed on U.S.
industry and the
public;
b. Ensure that Endangered Species Act decisions are based on strong science and
thorough analysis.
8. Modernizing our infrastructure
a. Support the White House Public/Private Partnership Initiative to
modernize U.S.
infrastructure;
b. Remove impediments to infrastructure development and facilitate
private sector
efforts to construct infrastructure projects serving American needs;
c. Prioritize DOI infrastructure needs to highlight:
1. Construction of infrastructure; 2. Cyclical maintenance;
3. Deferred maintenance.
9. Reorganizing for the next 100 years
a. Improve alignment and integration of the DOI organizational structure;
b. Redistribute organizational resources (people and funding) to enhance mission
achievement and improved public service;
c. Improve organizational alignment with Executive Branch counterparts
with major
land management assets or influence.
10. Achieving our goals and leading our team forward
a. Senior executives are expected to provide leadership in achieving
goals of the
President and the Secretary;
b. The Management Team is expected to:
1. Ensure cost-effective operations and quality service to the public;
2. Facilitate organizational cooperation and conflict resolution;
3. Ensure the workplace environment is conducive to employee productivity and
safety;
4. Hold individuals accountable for actions that violate DOI policies and
requirements.
Other Key Initiatives
1. Employment of veterans
2. Supporting DOI infrastructure needs

3. Creating jobs in the American economy
4. Access to outdoor recreation opportunities

about the 1002 stipulations and BMPs

Sent from my iPhone
Todd E. Hopkins
US Fish & Wildlife Service

From:	Brown, Randy
To:	Wendy Loya
Cc:	Paul Leonard; John Trawicki; Jennifer Reed; Joanna Fox; Hollis Twitchell; Drew Crane; Angela Matz; Christopher Latty; Patrick O"Dell; Stephen Arthur; Steve Berendzen; Roger Kaye; Ryan Wilson; Joshua Rose; Christopher Putnam; Kevin Doherty; Todd Hopkins; Tracy Fischbach; Greg Siekaniec; Mary Colligan; Swem, Ted
Subject:	Reclamation issues
Date:	Thursday, June 21, 2018 11:07:19 AM
Attachments:	Woody_etal_2010.pdf

In our discussion on reclamation b5 -dp [redacted] The attached article provides a fascinating account of this process and provides several case studies on hard rock mineral mines in the United States. In addition, the authors provide recommendations for improvement of the process, one of which was to impose a "reclaim as you go" program, b5 -dp [redacted]

Randy

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Randy J. Brown
Fishery Biologist
U.S. Fish and Wildlife Service
101 12th Ave., Room 110
Fairbanks, Alaska 99701

Phone: (907) 456-0295
E-mail: <randy_j_brown@fws.gov>

PERSPECTIVE:
POLICY

The Mining Law of 1872: Change is Overdue



Satellite image of the Sumpter Mine near Sumpter, Oregon (from Google Earth). This is an abandoned placer gold mine occupying 14 km of the Powder River floodplain and destroying its channel.

This article is a product of the Environmental Concerns Committee of the Western Division of the American Fisheries Society.

Carol Ann Woody,
Robert M. Hughes,
Eric J. Wagner,
Thomas P. Quinn,
Leanne H. Roulson,
Lori M. Martin, and
Kitty Griswold

Woody is the proprietor of Fisheries Research and Consulting.
Hughes is a senior research scientist with Amnis Opes Institute, a visiting professor in the Laboratory of Fish Biology at Universidade Federal de Lavras, and a courtesy associate professor in the Department of Fisheries and Wildlife at Oregon State University. He can be contacted at hughes.bob@epa.gov.
Wagner is a senior scientist at the Fisheries Experiment Station of the Utah Division of Wildlife Resources.
Quinn is a professor in the School of Aquatic and Fishery Sciences at the University of Washington.
Roulson is president of the Western Division of the American Fisheries Society.
Martin is president elect of the Western Division of the American Fisheries Society.
Griswold is an affiliate professor in the Department of Biological Sciences at Idaho State University.

ABSTRACT: Hardrock mining for metals has been, and is, an economically important land use in all western U.S. states. However, metals contamination associated with mining can be highly toxic to aquatic life, the composition of metal-bearing rock often leads to acid mine drainage and increased concentrations of dissolved metals, and mine-related disruptions to soil and water often produce excess fine sediments and altered stream flows. Such environmental degradation leads to large numbers of perpetually polluted streams and impaired aquatic life and fisheries. The primary U.S. law governing mining, the General Mining Law of 1872, was passed during the pick-and-shovel era to encourage economic growth; however, modern mining processes are massive in extent, highly mechanized, and incorporate additional toxic chemicals for leaching metals from ores. We provide an overview of hardrock mining impacts to aquatic life, a set of mining case studies, and suggestions for amending U.S. mining law. Our hope is that this article will lead to improved management and rehabilitation of existing mine sites and sufficient protections for the aquatic life and fisheries likely to be disturbed by future mines.

La ley de minería de 1872: un cambio retrasado

RESUMEN: la minería metalúrgica subterránea ha sido, y aún es, una actividad económicamente importante en cuanto a uso de suelo en los estados del oeste de los Estados Unidos de Norteamérica. Sin embargo, la contaminación por metales asociada a la minería puede ser altamente tóxica para la vida acuática, la composición de las rocas que contienen metales suele derivar en drenaje ácido de mina e incrementar la concentración de metales disueltos y las alteraciones en el suelo y agua relacionados con la minería pueden producir un exceso de sedimentos finos que alteran el cauce de los ríos. Tal degradación ambiental da lugar a un considerable número de cauces permanentemente contaminados, lo que pone en peligro tanto a la vida acuática como a las pesquerías. La ley directriz de minería de los Estados Unidos de Norteamérica, La Ley General de Minería de 1872, fue decretada durante la época de "pico y pala" con el fin de promover el crecimiento económico; no obstante, los actuales procesos de minería son extensivos, altamente mecanizados e incorporan químicos tóxicos para lixiviar metales a partir de minerales. En este trabajo se presenta una revisión de los impactos de la minería subterránea en la vida acuática, un grupo de minas como casos de estudio y sugerencias para modificar la Ley de Minería de los Estados Unidos de Norteamérica. Nuestra esperanza es que la presente contribución de lugar a un mejoramiento en el manejo y rehabilitación de las minas existentes y a suficientes medidas de protección para la vida acuática y las pesquerías que puedan ser alteradas por la explotación de más minas en el futuro.

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Introduction

The U.S. General Mining Law of 1872 governs mineral extraction (e.g., uranium, copper, gold, etc.) on about 147 million ha of public lands in the western United States, an area equal to approximately 38% of the nation (National Academy of Sciences 1999). The 1872 law makes mining a priority use on most of these lands, guarantees priority rights for minerals extraction, and was originally intended to encourage economic growth by conveying public lands to private owners for the purpose of mineral extraction. In practice, applications to mine public lands often cannot be denied despite deleterious impacts to other resources. Under this law, a miner can purchase (patent) the surface estate and mineral rights to federal land for $1–2/ha by demonstrating the presence of a valuable mineral deposit. Currently, there is a year-to-year moratorium on new patents but this is not a permanent solution. Due diligence, i.e., $100 of annual spending on mining activity, is required, but even if millions of dollars worth of minerals are extracted from these public lands, no fees or royalties are required in return (Bakken 2008), resulting in an estimated annual loss of revenue of $160 million to the U.S. government (Pew Foundation 2009). This law remains in effect, despite serious environmental and economic issues caused by hardrock mining practices and a shift in priority use on federal lands. In addition to the Mining Law of 1872, other federal laws apply to regulate the effects of hardrock mining (e.g., Clean Water Act, National Environmental Protection Act). However, because of the magnitude of the issue and the antiquated nature and primacy of the Mining Law of 1872 a comprehensive reform of that law is needed. Our focus in this article is hardrock metal mining, the extraction of metals found in hard rock geological formations. Placer mining of alluvial deposits is also governed under the Mining Law of 1872 and is associated with damage to aquatic life (e.g., Sumpter Mine on the Powder River, Oregon), but is not a focus of this article. Related concerns also pertain to surface coal mining, which is regulated by a different under-protective law (Surface Mining Control and Reclamation Act of 1977).

Impacts to fisheries from hardrock metal mining result from both abandoned and active mines. The U.S. Environmental Protection Agency (USEPA) estimates that there are 500,000 abandoned mines in the United States; 40% of western headwater streams are polluted from mining. Clean-up costs are estimated at $32–72 billion (USEPA 2000). Under the Mining Law of 1872, mining companies are not required to provide adequate insurance for clean up and reclamation of federal lands. Perhaps more troubling, many mines slated for clean-up require long-term or perpetual water treatment (USEPA 2004). Such ongoing water contamination threatens drinking water supplies, valuable fisheries, wildlife, agriculture, recreation, tourism, human health, and industries that rely on clean water. In effect, the 1872 law shifts wealth from the United States public to mining companies, and shifts liability from those companies to the taxpayer (USEPA 2004).

Most high-grade, accessible mineral deposits in the United States are already exploited; therefore, new hardrock mining ventures generally focus on low-grade ore deposits. The Mining Law of 1872 and relatively high prices allow for low-grade ore to be marginally profitable because mining corporations are not required to purchase sufficient reclamation insurance. If there is a disaster or massive reclamation expense, they can simply abandon the site and declare bankruptcy. The quantity of waste material generated can be massive, with mine waste areas covering hundreds of hectares and containing tens to hundreds of millions of tons of spoil. For example, the proposed Pebble Mine in the headwaters of Bristol Bay, Alaska, has an estimated mineral resource of less than 1% copper, gold, and molybdenum; 99% of the estimated 7.5 billion tons to be excavated are projected to be acidic waste that will remain on site in perpetuity (www.dnr.state.ak.us/mlw/mining/largemine/pebble/index.htm). The processes used to access and extract minerals in modern mining operations create extensive ecosystem disturbance that can lead to long-term adverse effects to ground water, aquifers, surface water, aquatic resources, terrestrial vegetation, wildlife, soils, air, and cultural resources. Typical environmental effects are associated with:

Access. In remote areas, road construction and increased human activity lead to a variety of ecological effects, either directly related to the roads or the increased number of people accessing the area.

Earth disturbance. To reach and extract desired minerals, most hardrock mining operations displace massive amounts of soil and rock, either at the surface or underground.

Waste piles. Waste rock, spent ore, or tailings are generally disposed of in large heaps, ponds, or tailing impoundments, which can occupy hundreds of hectares. If these facilities are poorly designed, improperly constructed, or prematurely abandoned, their failure can lead to long-term contamination of surface and ground water.

Toxic dust. Toxic dust from dried-up tailings ponds, open pits, roads, and trucks hauling crushed ore can be carried by wind far from the mine site and contaminate surface and ground water as well as air and terrestrial vegetation.

Toxic processing chemicals. Desired metals are extracted or leached using chemicals that can be toxic if released into the environment (e.g., sodium cyanide, mercury, sulfuric acid, xanthates).

Acid mine drainage (AMD). Exposure of sulfide minerals, frequently associated with metallic ores, can create acidic conditions and leach metals into local waters. This AMD constitutes one of the most serious and common water pollution problems associated with mining (USEPA 1994; Sherlock et al. 1995); perpetual treatment may be required.

Water and soil contamination. Even without acidic conditions, metals can be discharged from mine sites and enter surface water, ground water, and soils. This can cause significant damage to aquatic life, vegetation, and terrestrial wildlife, and poses a hazard for human health. Toxic loading of stream waters can alter the assemblage structure of invertebrates (Clements et al. 2000; Maret et al. 2003), invertebrates and fish (Hughes 1985), and fish behavior (DeCicco 1990). Those toxic metals also contaminate water and sediment and bioaccumulate in fish tissues (Harper 2009), leading to reduced fitness or death (National Academy of Sciences 1999).

Flow alteration. Impoundment of water and stream diversions can lead to loss of habitat for fish spawning and rearing.

The perception that modern mining techniques are vastly improved over historic methods was recently challenged by a comprehensive study of modern U.S. mines (Maest et al. 2005; Kuipers et al. 2006). For example, the study compared predicted water quality impacts to observed impacts found at a sample of 25 U.S. mines. In summary:

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100% of mines predicted compliance with water quality standards prior to operations (assuming pre-operations water quality was in compliance).

76% of mines exceeded water quality criteria as a result of mining.

64% of mines employed mitigation measures that failed to prevent water quality contamination.

Examples of mining impacts on aquatic resources

Without responsible laws and policy, and adequate reclamation and remediation, existing and future hardrock mines pose a risk to fish-bearing waters, in addition to the legacy effects of abandoned mines. Numerous examples of valuable fisheries and aquatic ecosystems harmed by hardrock mining exist across the western United States. High metals prices and demand for raw materials have created a modern minerals rush, with existing mines expanding, new claims being staked on public lands, and old mines reopening. Select case studies are presented to exemplify frequent compatibility issues existing between fisheries resource conservation and hardrock mining. These are not rare occurrences; USEPA (2004) identified 156 hardrock mining sites in the United States with past or potential Superfund liabilities of $1 million or more each.

Alaska

Red Dog Mine

The Red Dog Mine is located in northwest Alaska, near Kotzebue, and has been in operation since 1989 (www.reddogalaska.com/). It is the largest zinc mine in the world, providing 10% of the world's zinc (http://northern.org/news/epa-rescinds-key-red-dog-mine-permit-limits; Szumigala et al. 2009), and has polluted Wulik River tributaries with zinc, lead, selenium, and cyanide. The Wulik River is the drinking water source for the native village of Kivalina and the location of a subsistence and sport fishery for Pacific salmon (*Oncorhynchus* spp.), Dolly Varden (*Salvelinus malma*), and Arctic grayling (*Thymallus arcticus*). Observed shifts in overwintering sites by Dolly Varden were reported by DeCicco (1990; 1996), coincident with increased metals in 1989. Natural levels of zinc are high (approximately 10 times the state water quality standards in 1989), but rose to as much as 200 times higher once mining began in 1989. Because natural levels of minerals are high, the regulatory framework for water quality on Red Dog Mine is complex. However, tools to differentiate naturally-occurring metals vs. anthropogenic sources are available (Kelly and Hudson 2007). High levels of metals associated with dust from haul trucks were measured as highly toxic and are potentially affecting the entire watershed (Ford and Hasselbach 2001). In addition, the mine has been subject to numerous regulatory actions and currently the permit to expand the mine has been rescinded. In 1991, the mine operator was cited for 134 violations of effluent limitations for metals and pH, and spent $11 million in 1991 to route Red Dog Creek around the mine and isolate it from seepage (USEPA 1991). Dead fish from the Wulik River, approximately 40 km downstream from the mine, were discovered periodically by the public (ADNR 2004), suggesting that water chemistry samples were insufficiently protective of aquatic life, which is similar to what was concluded by Ohio EPA (1990) in its comparison of chemical and biological criteria. The mine operators paid a $1.7 million penalty for illegal discharges in 1997, and in 2008 agreed to pipe mine wastes to the Chukchi Sea or pay an additional $8–20 million penalty.

Kensington Mine

The U.S. Army Corps of Engineers approved a permit application by Coeur Alaska to deposit up to 4.5 million tons of gold mine tailings from the Kensington Mine into Lower Slate Lake, Alaska, which hosts Dolly Varden and threespine stickleback (*Gasterosteus aculeatus*). The permit was approved even though Coeur Alaska agreed in its application that these two fish species would be extirpated from the lake by the waste. The U.S. Supreme Court upheld the Corps' decision in 2009 because of conflicting and confounding laws and regulations governing when mine waste is treated as fill or as pollutant discharge (*Couer Alaska, Inc. vs. Southeast Alaska Conservation Council*). The Supreme Court decision sets a legal precedent that may allow other mining operations to avoid adherence with Clean Water Act water quality criteria by petitioning the Corps of Engineers to redefine pollutant-containing waste material as fill. This is a key issue also related to mountaintop removal and valley fill for surface coal mining in the Appalachians (USEPA 2009b).

Arizona

Pinto Valley Mine

Pinto Valley Mine, an open pit copper mine in Gila County, began operations in 1972, withdrawing water from the local aquifer and discharging to an intermittent section of Pinto Creek. Copper and zinc concentrations exceeded Arizona aquatic life criteria, metals bioaccumulated, and fine sediments buried natural substrates by an average of 15 cm, converting the reach from riffles and pools to a homogeneous run. Mountain sucker (*Catostomus platyrhynchus*) and western mosquitofish (*Gambusia affinis*) were greatly reduced in the polluted reach and 20 macroinvertebrate taxa were eliminated within 4 years. During spills and high flow events, dissolved metals were sufficient to kill fish (Lewis and Burraychak 1979).

California

Iron Mountain Mine

Iron Mountain Mine was a copper mine in operation from the 1860s through 1963 in northern California, near Redding (www.epa.gov/superfund/eparecovery/iron_mountain.html). This mine became infamous for developing the most acidic water in the world with a pH of -3.6 and it is estimated that the AMD from this site will persist for at least 3,000 years (www.epa.gov/aml/tech/imm.pdf; National Academy of Sciences 1999). Water from Iron Mountain Mine entered adjacent streams and eventually Keswick Reservoir, a run-of-the-river reservoir on the Sacramento River. Streams draining Iron Mountain Mine are devoid of aquatic life downstream of the mine. As early as 1900, the California Fish Commission investigated fish kills in the Sacramento River attributed to pollution from the mine. State records document more than 20 fish-kill events in the Sacramento River downstream of Iron Mountain Mine since 1963. AMD from Iron Mountain Mine killed 100,000 or more fish on separate occasions in 1955, 1963,

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and 1964; and at least 47,000 trout died during a one-week period in 1967. The AMD from Iron Mountain Mine has harmed four runs of Chinook salmon (*O. tshawytscha*), steelhead (*O. mykiss*), and resident rainbow trout, as well as hundreds of benthic species (Hallock and Rectenwald 1990). The National Marine Fisheries Service lists the winter-run and spring-run Chinook salmon, which spawn in the Sacramento River near Redding, as endangered and threatened, respectively, pursuant to the Endangered Species Act. Iron Mountain Mine is now a Superfund site.

Leviathan Mine

Leviathan Mine began operations in 1863 on the eastern side of the Sierra Nevada (Alpine County), and from 1952 to 1962 (www.epa.gov/superfund/sites/npl/nar1580.htm) consisted of an open pit mine covering about 101 ha. Acid mine drainage developed during operations; additional contaminants include aluminum, arsenic, chromium, copper, iron, nickel, selenium, and zinc. The AMD flows into Leviathan Creek at numerous points, devastating aquatic life until Leviathan Creek joins the East Fork of the Carson River. For most of the year, roughly half of the flow in Leviathan Creek is composed of AMD (http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/84e3d3f74809433788257233007 94f02/93009e9e968d570788257007005e9445!OpenDocument). The Aspen Seep releases AMD containing elevated levels of aluminum, copper, iron, and nickel into Aspen Creek. Each of these metals has historically exceeded EPA water quality criteria for aquatic life by over 500 times. Since 1983, California has invested millions of dollars to contour the pit and surrounding waste piles, channel Leviathan Creek around the major disturbed area, and capture the most concentrated flow in a series of ponds. Leviathan Mine is now a Superfund site.

Colorado

Summitville Mine

The South Mountain mineral reserves, located in southwestern Colorado near Del Norte, were mined from 1984 to 1992 as a gold and silver open pit heap leach operation. Acid mine drainage and cyanide releases from the open-pit mine and heap leach pad were lethal to all fish and aquatic life for 29 km downstream in the Alamosa River (www.epa.gov/region8/superfund/co/summitville/). Summitville Mine was determined by the U.S. Geological Survey (USGS) to be the dominant source of aluminum, copper, iron, manganese, zinc, and acidity in the Alamosa River (http://pubs.usgs.gov/of/1995/ofr-95-0023/summit.htm#King.1995a). As of 2005, water quality criteria for aquatic life were regularly exceeded, partly as a result of contaminated ground water inputs as well as release of contaminated water from the Summitville Dam impoundment. The mine operator declared bankruptcy in 1992 and the USEPA assumed control of the site as part of an Emergency Response Removal Action. The mine was listed as a Superfund site in 1994; cleanup costs have exceeded $150 million and perpetual water treatment is required.

Idaho

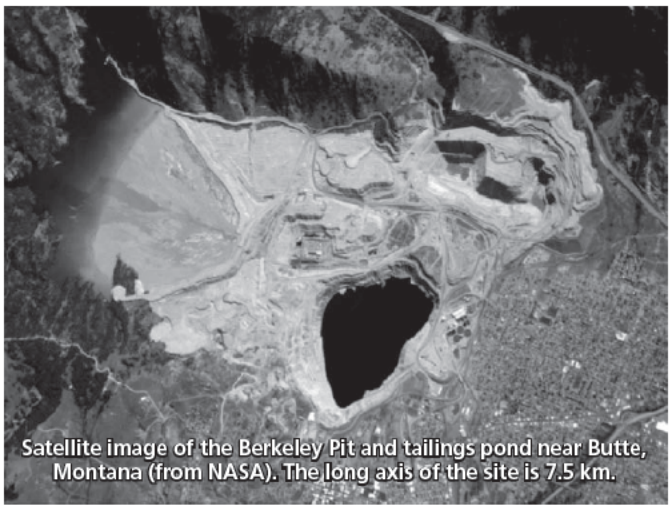
Coeur d'Alene Mining District

The Coeur d'Alene Mining District is located in the panhandle of northern Idaho. This mining area has produced lead, silver, gold, and zinc from the 1880s to the present. Widespread contamination of water and soils resulted from numerous mining operations. The South Fork Coeur d'Alene River and tributaries, Coeur d'Alene River and lateral lakes, Lake Coeur d'Alene, and the Spokane River are associated with the Bunker Hill-Coeur d'Alene Basin Superfund site, a "mining megasite" (National Academy of Sciences 1999). Tributaries to the North Fork Coeur d'Alene River are also water quality impaired, associated with mining. Water quality, biological, and hydrologic conditions have been affected, and reduced native species diversity and abundance have been measured within study areas downstream of mined areas compared to non-mined sites because of metals contamination (Ellis 1940; Hoiland et al. 1994; Maret and MacCoy 2002). Metals-contaminated water also has impaired westslope cutthroat trout (*O. clarkii lewisi*) fisheries and contributed to the extirpation of bull trout (*Salvelinus confluentus*) from the Coeur d'Alene Basin upstream of Lake Coeur d'Alene. Spawning migrations of introduced Chinook salmon have also been affected, which has implications for their long-term sustainability and survival (Goldstein et al. 1999). The Idaho Department of Health and Welfare (IDHW 2003) issued a fish consumption advisory for Lake Coeur d'Alene based on lead, arsenic, and mercury concentrations in fish flesh. The advisory cites historical mining practices in the Coeur d'Alene watershed as the source of the contaminated soil and water in the area. The fishes sampled included bullhead (*Ameiurus* sp.), kokanee (*O. nerka*), and largemouth bass (*Micropterus salmoides*). Those species were chosen because they are consumed extensively by tribal anglers (IDDH 2003). Cleanup costs to the taxpayers as of 2001 were $212 million (Steele 2001). Recent analyses estimate attainment of water quality goals in just the upper basin of this mining district could take several centuries at costs of $1–2 billion (http://yosemite.epa.gov/R10/CLEANUP.NSF/9a80cd5553c69ff588256d14005074ad/97c56add3adf9467882575590077 1691/$FILE/Draft_Upper%20CDA%20Basin%20FFS_Report_Executive_Summary%282%29.pdf).

Blackbird Creek Mine

Blackbird Creek Mine covers approximately 336 ha of private patented mining claims and 4,047 ha of unpatented claims, all within the Salmon National Forest, Idaho. Active mining for cobalt and copper occurred from the late 1800s to the 1980s, but the mine is currently dormant. Shaft and open pit methods were used and tunnels and waste rock piles occur along 13 km of Meadow and Blackbird creeks. Waste piles include as much as 2 million m^3 of material. Acid drainage from mines and spoil, and high levels of arsenic, copper, cobalt, and nickel, have been documented downstream in both surface water and sediments; copper levels exceeded USEPA water quality criteria (www.atsdr.cdc.gov/HAC/PHA/blackbird/bla_p3.html; www.epa.gov/superfund/sites/npl/nar1369.htm). Panther Creek, downstream of Blackbird Creek Mine, once supported fish, but by 1960, steelhead and Snake River spring/summer Chinook salmon were extirpated from it. Contaminants released at Blackbird Creek Mine were indicated as causal (www.darrp.noaa.gov/northwest/black/index.html). Blackbird Creek Mine is a registered public health hazard and a designated Superfund site.

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Satellite image of the Berkeley Pit and tailings pond near Butte, Montana (from NASA). The long axis of the site is 7.5 km.

Montana

The Berkeley Pit

The Berkeley Pit operated from 1955 to 1985 as an open pit copper sulfide mine in Butte, Montana. The excavated mine pit is 542 m deep and 1.4 km across the rim. The pit filled with water once mining was completed, and it now contains about 1 trillion L of acidic (pH 2.7–3.4) water and metals (aluminum, arsenic, cadmium, copper, zinc; Twidwell et al. 2006). Over 193 km of the Clark Fork River and flood plain, and Milltown Reservoir, are contaminated by approximately 5 million cubic meters of contaminated mine tailings that washed downstream from Butte and collected behind the Milltown Dam (removed in 2008). Scientists with USEPA concluded that the metals behind the dam were contaminating local drinking water wells and causing large fish kills during high water events and ice scours (http://cfrtac.org/clarkforksite.php). Silver Bow Creek, which drains Butte, is nearly devoid of aquatic life (Hughes 1985). The pit and much of the surrounding mine facilities, including the Clark Fork River, form the largest Superfund site in the United States. Reclamation and remediation are ongoing and perpetual water treatment is required.

McLaren Mine

McLaren Mine in Cooke City, Montana, operated from 1933 to 1953 to extract gold, silver, and copper through use of heap leach cyanide methods (http://serc.carleton.edu/research_education/nativelands/ftbelknap/environmental. html). In 1950, a tailings dam failure on Soda Butte Creek released about 115,000 m^3 of metal laden effluent downstream. As much as a 60-cm-deep layer of tailings were deposited as far as 8 km downstream (Ecology and Environment 1988). Copper concentrations, documented as highly toxic to aquatic life (Sorensen 1991; Eisler 2000; Hecht et al. 2007), are elevated in macroinvertebrates and fish. Greater chronic metals toxicities occur in spring runoff compared to fall base flows (Nimmo et al. 1998; Marcus et al. 2001), indicating continued leaching. Soda Butte Creek was known for "fast fishing and large trout" during the late 1800s, but fishing opportunities declined with its water quality (USFWS 1979).

Zortman-Landusky Mine

The Zortman-Landusky gold and silver mine began operation in the 1880s. Mining was extended onto lands purchased from the Fort Belknap Indian Reservation in 1895 (Klauk 2009). Modern heap leach activity began in the late 1970s, and an environmental impact statement (EIS) was completed by the state in 1979, when the mine covered 109 ha. AMD impacts resulted from several spills, including a 2,953 L leak of cyanide-tainted solution from a containment pond in 1982. A rupture in a section of piping used in the mine's cyanide sprinkling system expanded the spill, releasing 196,841 L of cyanide solution onto lands and creeks (Klauk 2009). Local tap water revealed cyanide concentration levels above drinking water standards and the community's local water system was shutdown. Over the next two years, eight separate cyanide spills occurred (Klauk 2009). In September 1986, 75 million L of treated cyanide solution were released onto 7 ha of land when a solution pond was at risk of overflowing after a heavy rainstorm. The spills have contaminated streams and ground water throughout the area. By the late 1990s, total land disturbance reached almost 486 ha with about half on Bureau of Land Management (BLM) lands. In 1998, Zortman-Landusky, now consolidated with Pegasus Gold Ltd., filed for bankruptcy. Despite a $36 million settlement from a lawsuit filed under the Clean Water Act in 1996, the agencies had to file a notice of an $8.5 million reclamation bond shortfall with the bankruptcy court (Klauk 2009). Although $1.0 million of the shortfall was eventually awarded, the bankruptcy was finalized in December 2003, and BLM and the Montana Department of Environmental Quality assumed responsibility for water storage and treatment in perpetuity (BLM 2010). The BLM (2010) estimated that it will cost approximately $528,000/y to manage the site. In addition, the state expects to spend $240,000 annually on AMD treatment through 2017, and has established a fund to pay for treatment beyond 2017.

Nevada

Caselton Mine

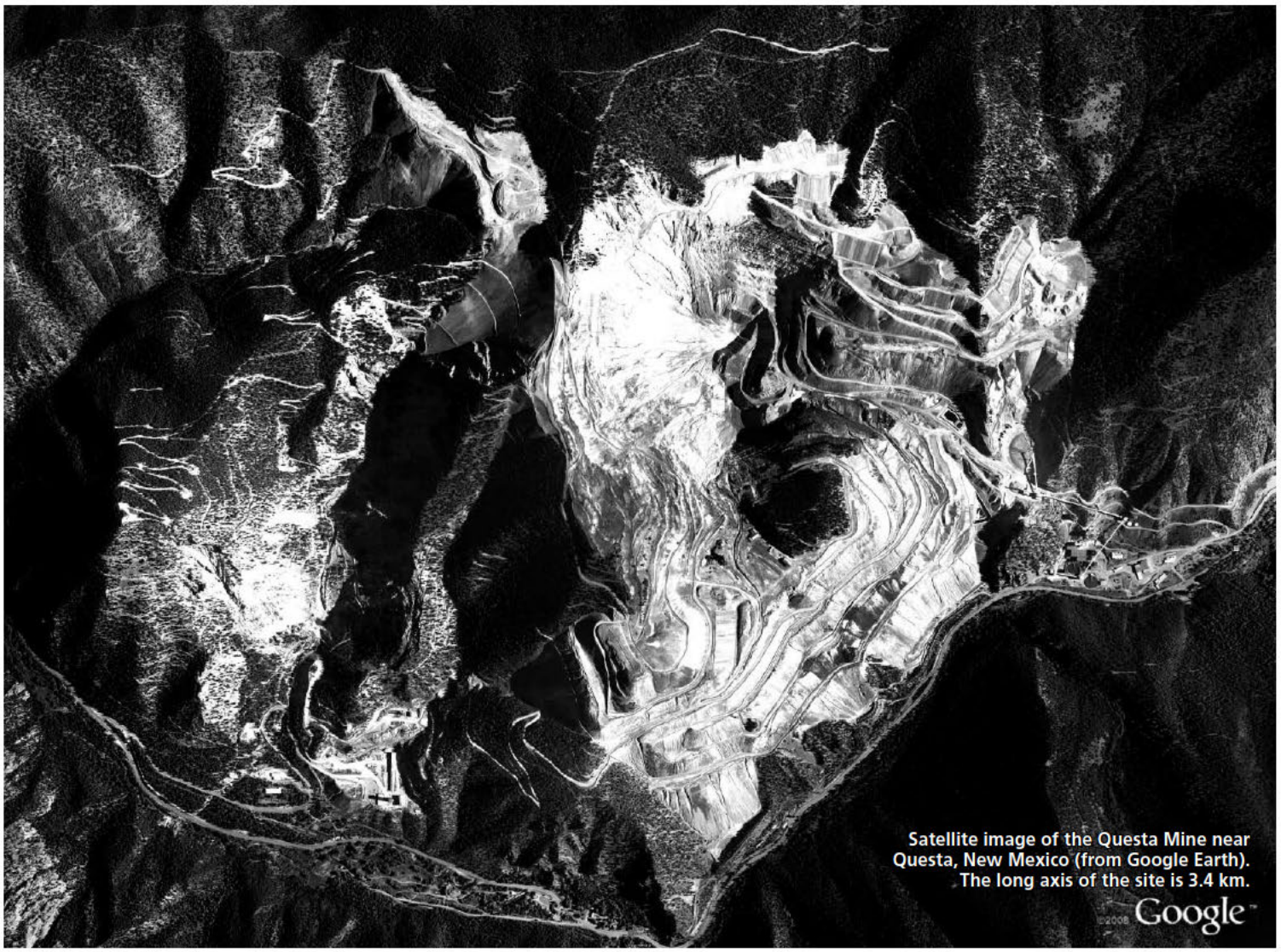
The Caselton Mine in Lincoln County began production in 1863 for silver, gold, lead, zinc, copper, and manganese. Part of the site continues to be marginally active, but most of it has been abandoned (IAMLET 1999). The value of metals produced was approximately $130 million, and approximately 1,147,000 m^3 of tailings remain, with an estimated cost of $11 million for on-site reclamation. That estimate does not include downstream treatment of contaminants.

New Mexico

Questa Mine

The Questa Mine Superfund site is located northeast of Santa Fe, and includes an active molybdenum mine, mill, tailings ponds, and tailings pipeline, as well as the Red River (USEPA 2010). The open pit mine opened in 1965 and the lower 13 km of the Red River were deemed "dead" by the New Mexico Water Quality Commission in 1994. Numerous pipeline breaks, AMD from the tailings ponds, aluminum, arsenic, cadmium, chromium, cobalt, fluoride, iron, lead, manganese, sulfate, and zinc have

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Satellite image of the Questa Mine near Questa, New Mexico (from Google Earth). The long axis of the site is 3.4 km.

contaminated ground water and the Red River floodplain. Such contaminants threaten the Red River fisheries for brown trout (*Salmo trutta*) and cutbows (*O. clarki* x *O. mykiss*), the endangered Rio Grande cutthroat trout (*O. c. virginalis*), and a rainbow trout hatchery.

Oregon

Formosa Mine

The Formosa Mine (copper, zinc, thorium) on Silver Butte Creek near Riddle operated from 1990 to 1993. The mine has contaminated 18 miles of the Umpqua River watershed in western Oregon (USEPA 2007). The mine currently releases approximately 19 million L of AMD annually, containing up to 13,000 kg of dissolved copper and zinc, metals known to be highly toxic to fish (Dethloff et al. 1999; Baldwin et al. 2003). Consuming fish from the system poses a health risk to humans. Metals pollution is eliminating prime habitat for coho salmon (*O. kisutch*) and steelhead. Aquatic insects have disappeared from the upper reaches of the creek.

Utah

Atlas Mine

The Atlas Mine, located near Moab along the Colorado River, opened in 1952 as a uranium mine. The mine closed in 1984 but left an approximately 178 ha waste site and a 53 ha (16 million ton) tailings pile in the floodplain that leached into ground water and the Colorado River, creating a dead zone. Uranium concentrations in the dead zone are 1,660% greater than background levels. Flooding of the site had the potential of further contaminating the water supplies of millions of downriver humans. The U.S. Geological Survey observed 100% mortality of caged fish placed into the dead zone because of ammonia concentrations 750 times acutely lethal levels. The U.S. Fish and Wildlife Service considered leaching from the tailings as jeopardizing four endangered fish species: humpback chub (*Gila cypha*), bonytail (*G. elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), and razorback sucker (*Xyrauchen texanus*). The tailings removal and burial began in 2009 at a cost of approximately $1 billion and are projected to require 20 years. The mine operator had posted a $5 million reclamation bond, and filed for bankruptcy (http://healutah.org/news/; http://grandcanyontrust.org/utah/uranium_history.php).

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Washington

Midnite Mine

The Midnite Mine was an open-pit uranium mine on the Spokane Indian reservation in eastern Washington, and operated from 1955 to 1981. The Dawn Mill site, just off the reservation, also processed uranium. In the 1990s, both sites were found to be leaking radioactive metals, metals, and AMD into ground water and neighboring streams, including Blue Creek, which drains to Lake Roosevelt, the Columbia River reservoir behind Grand Coulee Dam. Blue Creek is used for spawning and rearing by rainbow trout, Paiute sculpin (*Cottus beldingi*; a species of concern in Washington), and other fishes (USEPA 2009a). Midnite Mine is currently an active Superfund site.

Holden Mine

The Holden Mine, in the Okanogan-Wenatchee National Forest in Chelan County, eastern Washington, operated from 1938 to 1957. It was one of the largest copper mines in the United States, and zinc, silver and gold were also mined. The AMD and metals leach into Railroad Creek, a tributary to Lake Chelan (Johnson et al. 1997). Risks to aquatic life include degradation of surface water quality and streambed armoring. Additionally, spoil piles along stream banks pose a risk to the aquatic community. A flood in 2003 required an emergency cleanup (www.fs.fed.us/r6/wenatchee/holden-mine/flood-damage-2003.shtml). The Holden Mine is an active Superfund site.

Wyoming

Smith-Highland Ranch Mine

The Smith-Highland Ranch Mine is a uranium mine near Douglas in northeast Wyoming that began operations in 1988. In 2008, the Wyoming Department of Environmental Quality (WDEQ) issued a notice of violations to the mine operator for 80 spills over multiple years, pond leaks, well casing failures, failure to restore ground water quality, and a grossly inadequate reclamation bond. Despite those concerns with contaminating ground water, mine self-monitoring, and inadequate WDEQ oversight, the mine has been allowed to continue to operate (http://trib.com/news/state-and-regional/article_b8f9b03a-d250-51f5-a1fc-f34646cfc567.html; www.powertechexposed.com/Cameco_Wyo_mine_permit_violations.htm).

An example of possible future mining impacts

The preceding examples demonstrate fisheries impacts from mining and the poor track record for maintaining water quality suitable for aquatic life (Maest et al. 2005; Kuipers et al. 2006), leading to concerns for new mines and a continuing legacy of mineral extraction trumping all other uses of public land. For example, the Pebble Mine claim on Alaska state lands in the Bristol Bay watershed is part of a massive low-grade porphyry copper sulfide deposit also containing gold and molybdenum. Its development is projected to require an open pit mine (~6 km^2 in area and ~490 m deep), an underground mine, dams at or above 200 m high, a ~160 km long haul road and slurry pipeline, development of a port facility on Cook Inlet for fuel and concentrated mineral storage, and 1.1 billion L of water annually (www.dnr.alaska.gov/mlw/mining/largemine/pebble/2006/damaap.pdf; www.dnr.alaska.gov/mlw/mining/largemine/pebble/2006/swutorig.pdf; www.dnr.alaska.gov/mlw/mining/largemine/pebble/2006/gwsfkfinal.pdf). The region that contains the Pebble copper deposit has porous alluvial soils, abundant ground and surface water, interconnected watersheds, undefined seismic faults, significant seismic activity, little buffering, and a high concentration of sulfides that are known to produce AMD (USFS 1993; Northern Dynasty Mines Inc. 2005; HDR Alaska and CH2M Hill 2008a,b; http://earthquake.usgs.gov/eqcenter/recenteqsus/Maps/special/Alaska.php; Jennings et al. 2008).

The Pebble prospect conditions have serious implications for fisheries. Dissolved copper concentrations as low as 2–10 ug/L above background can alter the olfactory-mediated survival and migration of salmonids (Hecht et al. 2007; Sandahl et al. 2007). The waters draining the Pebble copper deposit are essential to spawning, incubating, rearing, and migrating salmon and non-salmonids, and drain into waters supporting diverse Bristol Bay fisheries. Bristol Bay is home to the world's largest wild sockeye salmon (*O. nerka*) fisheries, and sustains healthy productive fisheries of other salmonids, herring, and crab. The local seafood industry employs about 10,000 people annually; gross earnings reported in 2007 were over $100 million in international sales (www.sf.adfg.state.ak.us/Statewide/economics/). A 2007 study of sportfishing economic impacts in Alaska indicated expenditures of $1.4 billion dollars generating 15,879 jobs, of which, $989 million and over 11,000 jobs were attributed to the southcentral region which includes Bristol Bay (www.sf.adfg.state.ak.us/Statewide/economics/). The Bristol Bay exvessel commercial salmon fishery has a 20-year estimated average annual value of $125.7 million ($123.1 million for sockeye; Sands et al. 2008). National catch statistics for sockeye salmon alone (mostly from Bristol Bay) indicated an exvessel value of over $7.8 billion between 1950 and 2008 (www.st.nmfs.noaa.gov/st1/commercial/landings/gc_runc.html). Alaska Native peoples have relied on annual salmon returns to the rivers draining the Pebble copper deposit for subsistence for thousands of years; salmon still comprise 60–80% of their total subsistence harvest, which for the last 20 years has averaged over 100,000 salmon annually from the Nushagak and Kvichak drainages alone (Fall et al. 2006; Sands et al. 2008). The Pebble copper deposit lies under state land straddling both the Nushagak and Kvichak drainages, is adjacent to Lake Clark National Park and Preserve, is about 24 km upgradient of Lake Iliamna where millions of sockeye fry rear annually, and is in the headwaters of the Nushagak, a major Chinook salmon producer. The Nushagak and Kvichak river drainages have produced about 50% of all commercially harvested sockeye salmon from Bristol Bay for 125 years (ADFG 2008a,b; Fair 2003). Given the importance of sustainable fisheries in Bristol Bay and its drainages, it seems advisable to mount an ecologically and statistically defensible surveying program in the region, and to make the study designs and all data produced from surveying the region publicly available for independent peer review.

Given the history of hardrock mining documented above, the risks to fisheries like those in the Bristol Bay drainage are high. The value of these fisheries, and the livelihoods of those who

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depend on them, should be considered when making decisions about land use. However, the Mining Law of 1872 still maintains mineral extraction as the highest priority use of federal lands and the BLM is considering opening 0.5 million ha of federal lands around Pebble to mining, which would further exacerbate the threat to the fishery. As Senator Lee Metcalf explained in his address to the North American Wildlife Conference in 1974, the Mining Law of 1872 is the "only law that puts the land use decision entirely in the hands of the developer" (Bakken 2008). Attempts to change the legislation in the 1990s failed due to powerful corporate interests and public apathy. An update to the Mining Law of 1872, signed by Ulysses Grant, is long overdue.

Future policy needs

Healthy sustainable fisheries support important local and national economies and depend on clean water and healthy watersheds. The examples presented, along with a wide array of other scientific evidence concerning hardrock mining, have demonstrated frequent incompatibility of hardrock mining with conservation of important fisheries resources due to outdated and inadequate regulations and policy. Although the American Fisheries Society has a surface mining policy (#13; www.fisheries.org/afs/policy_statements.html) in place, we recommend that the policy be revised to address more thoroughly the potential impacts of hardrock mining on fish and aquatic ecosystems. More importantly, and because hardrock mining is a vital industry, we recommend that the U.S. Congress revise the Mining Law of 1872 to:

1. **Establish clear environmental standards.** Specific standards for environmental protection need to be strengthened and elucidated within mining law, including:
   a. ***Reclamation.*** Mine sites should be reclaimed to sustain uses conforming to the applicable land use plan of the region, not just pre-existing, degraded conditions. Concurrent reclamation of mined lands prior to expanding onto undisturbed land can reduce overall impacts as well as provide data on the efficacy of the proposed reclamation plan. Such reclaim-as-you-go programs increase the probability that the proponent will cover the cost of reclamation before the mining operation shuts down.
   b. ***Fish and wildlife protection.*** Habitat and fish and wildlife assemblages should be restored to pre-mining conditions, at a minimum.
   c. ***Surface and ground water protection.*** Current federal law does not adequately protect ground water from mining pollution and the requirements of mine reclamation are insufficient to maintain compliance with state and federal water quality standards. Operations should minimize damage to surface and ground water resources, restore to at least pre-mining hydrological conditions, and ensure compliance with water quality standards.
   d. ***Revegetation.*** Mined areas should be reseeded and planted with sufficient vegetation and success should be measurable and monitored. Native species should be encouraged and noxious species controlled.
   e. ***Prohibition of perpetual pollution.*** Before mining ceases, mine operators should meet water quality criteria required to protect desired aquatic species without the permanent treatment of water.
   d. ***Mitigation.*** Mitigation proposals should be accompanied by clear success/failure measurement criteria and clearly defined alternative(s) that are triggered if the proposed mitigation fails. When ranking mitigation alternatives, the costs and benefits of the potential environmental impacts of each scenario should be part of the economical feasibility analysis.
2. **Protect special places.** The U.S. government currently interprets mining as the highest priority and best use for public lands based on the Mining Law of 1872. However, many places are of significant environmental value and should deserve special protections.
   a. ***Designate special lands as off-limits to hardrock exploration and development.*** Wilderness study areas, lands recommended for wilderness designation, sacred sites, areas of critical environmental concern, lands supporting highly valued or ESA-listed fish or wildlife populations, roadless areas, lands in the Wild and Scenic River System or recommended for such, and lands administratively withdrawn or segregated should be off limits to mineral exploration and development that would directly or indirectly affect them.
   b. ***Allow land managers to appropriately value mining relative to competing uses of public*** **land.** Land managers should be able to weigh competing land uses and consider the impacts of mining and the potential for reclamation to a desired state before mine approval. No mine should degrade the environment, public health, or public safety. Land managers should have the ability to deny permits when appropriate or to include appropriate requirements to protect the environment for approved operations.
3. **Initiate fiscal reform to increase permittee financial responsibility.** In 2000, the U.S. Bureau of Land Management estimated $982 million worth of hardrock minerals were excavated from public lands, yet the mining industry paid no royalty on those minerals. Fiscal reform is needed to aid in restoring damaged watersheds, and should include:
   a. ***End patenting.*** Under the Mining Law of 1872, an area about the size of Connecticut valued at over $245 billion dollars has been patented for far less than the land value.
   b. ***Establish royalty fees.*** Fees for new and existing mines similar to those paid by the fossil fuel industry (e.g., 8%–12.5%) should be established and used for land and water rehabilitation.
   c. ***Statutorily ensure reclamation bonding.*** Adequate reclamation bonds with clear clean-up standards are needed to protect both the environment and taxpayers. Estimated clean-up liability for operating mines is estimated to exceed $12 billion to taxpayers because of inadequate bonds.
   d. ***Establish regulatory fees.*** Fees are needed in the permitting process for effectiveness monitoring, enforcement infrastructure, and research.
4. **Create funds to clean up abandoned mines.** No dedicated federal funds currently exist to clean up abandoned mine sites. A royalty fund of $32–72 billion should be established to clean up abandoned mine sites. A program should be clearly developed and implemented to evaluate, prioritize, and fund those projects.

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5. **Improve mine oversight and environmental protection.** Self-monitoring and self-reporting by the mining industry has frequently failed to protect waters and fishery resources because of irresponsible mining practices. Compliance with the Clean Water Act and state water quality standards must be achieved, including implementation of agency permit requirements and conditions, monitoring associated with National Pollution Discharge Elimination System (NPDES) permits, and other applicable regulations. Industry oversight from initial baseline studies to mine closure is needed, including:

   a. ***Independent peer review from exploration to closure.*** Annual technical reports and data should be prepared by independent mining consultants and released directly to the public as well as state and federal oversight agencies for review, critique, and improvement. Inadequacies in baseline studies and monitoring programs (including study design, site-scale design, standard methods, and indicators) should be documented and addressed (Hughes et al. 2000; Hughes and Peck 2008; Bonar et al. 2009). Agency recommendations should be considered and integrated or the status quo defended.

   b. ***Independent effectiveness monitoring.*** Independent or agency monitoring of water and sediment quality, flow regime, physical habitat structure, and biological assemblages (fish, benthic macroinvertebrates, algae, riparian vegetation) should be conducted at least during high and base flows as part of the mine permit and paid for by the permitee. Monitoring should be independent of the agencies responsible for mineral leasing, because of their roles in encouraging mining.

   c. ***Inspections.*** Unannounced inspections should be mandatory. Water quality samples should be split for independent analyses by independent laboratories, with oversight by responsible agencies for quality control. Regulatory agencies should be adequately funded to conduct rigorous and frequent inspections. In addition, the right of the public to reasonably request inspections should be guaranteed.

   d. ***Cessation of work.*** Failure to successfully address mining violations should require ceasing operations until appropriate remediation is addressed and implemented.

   e. ***Track violators.*** Operators (including firms and persons) that have a history of serious violations or are currently seriously violating laws should be ineligible for new or renewed permits and liable for criminal proceedings. Further, additional permits or permit renewals should not be considered until reclamation at other sites has been deemed appropriate and successful by the regulatory agencies and stakeholders involved.

   f. ***Right to sue.*** Citizens should have the right to file suit in federal and (or) state courts when operators or government agencies fail to implement and monitor best management practices.

   g. ***Risk analysis.*** Unanticipated events that lead to the release of metals, chemicals, dust, and debris pose serious risks to aquatic biota. Mine permitting and reclamation insurance should be developed within the context of risk assessment that takes into account landscape properties, climate, earthquake hazards, and extraction and reclamation methods.

6. **Fund research needs.** The National Academy of Sciences (1999) and USEPA (2004) recommended an aggressive and coordinated research program related to the environmental impacts of hardrock mining. A better understanding of mining practices, problems, and solutions is needed to prevent water quality degradation, guide rehabilitation of contaminated watersheds, and mitigate the effects of future hardrock mining.

7. **Follow the precautionary principle.** Time and again we have learned that it is more costly and uncertain to rehabilitate natural resources than it is to protect them. Given the inability of planners and engineers to prevent catastrophic failures, it is incumbent on the professionals that work with fisheries, wildlife, and other resources to carefully scrutinize any proposed new developments. As we write this piece, hundreds of cubic meters of oil are gushing daily from the seafloor in the Gulf of Mexico and drifting shoreward, in an event that was apparently not anticipated, and for which there were no adequate contingency plans. Recent history is replete with similar engineering shortcomings (e.g., Santa Barbara and *Exxon Valdez* oil spills, Tacoma Narrows and Minneapolis bridge collapses, Three Mile Island and Enrico Fermi nuclear plant meltdowns, *Challenger* and *Columbia* space shuttle explosions, Teton and Buffalo Creek dam collapses, Consol and Upper Big Branch mine explosions, Baie Mare and Aznalcollar mine spills). History teaches us that once initiated, mining projects continue no matter how serious the violations of permits. Therefore, the permitting process should assume that stated levels will be exceeded, and that catastrophes and spills will occur. The risks and benefits should be weighed accordingly following rigorous examination of mining and infrastructure plans, economic evaluation, ecological surveys, and peer review of all data.

Summary

The U.S. General Mining Law of 1872 allows mining operators to enter, explore, and begin the permitting process for a claim, but does not require a commitment to return the lands and waters to a state supporting aquatic life. Most mining practices require water in large quantities for some aspect of extraction, processing, or transport of the mined material and its byproducts. Therefore aquatic systems are heavily altered directly, indirectly, and cumulatively by mining. History has shown that the legacy impacts of mining are often significantly more persistent and expensive than those observed during active mining. Just as no mining company would consider it feasible to go back to nineteenth century mining practices and technology, U.S. citizens should expect mining projects to meet modern scientific standards by employing rigorous scientific assessment of all potential impacts, and by providing public access to all information gathered in those assessments in sufficient time for scientific peer review.

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Acknowledgments

We thank Aimee Fullerton, Wayne Hubert, Don Jackson, and one anonymous reviewer for manuscript review, and Amnis Opes Institute for partial funding of manuscript preparation.

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From: Wendy Loya (via Google Drive)
To: patrick_odell@fws.gov
Cc: stephen_arthur@fws.gov; christopher_latty@fws.gov; hollis_twitchell@fws.gov; angela_matz@fws.gov; edward_decleva@fws.gov; randy_j_brown@fws.gov; john_trawicki@fws.gov; jennifer_reed@fws.gov; joanna_fox@fws.gov; steve_berendzen@fws.gov; catherine_collins@fws.gov; tim_allen@fws.gov; roger_kaye@fws.gov; ryan_r_wilson@fws.gov; christopher_putnam@fws.gov; ted_swem@fws.gov; tracy_fischbach@fws.gov; drew_crane@fws.gov
Subject: Stips and BMPs - Invitation to collaborate
Date: Thursday, June 21, 2018 6:19:39 PM

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wendy_loya@fws.gov has invited you to **contribute to** the following shared folder:

Stips and BMPs

(See docs beginning on P. 452)

Edits due no later than: Wednesday 6/27 4pm

Google Folder with Stipulations and BMPs from NPRA Table 2.3 for FWS Staff Experts to edit for applicability for 1002 area. Please only edit those documents for which you have knowledge and expertise in, all edits should be tracked, but formatting changes can be accepted to keep document as readable as possible.

Thank you, let Wendy know if you have any questions.

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WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY						FWS Category
Alternative B-1	**Alternative B-2 Preferred Alternative**			**Alternative C**	**Alternative D**	
A-9 Best Management Practice Objective: Reduce air quality impacts. Requirement/Standard: All oil and gas operations (vehicles and equipment) that burn diesel fuels must use "ultra-low sulfur" diesel as defined by the Alaska Department of Environmental Conservation-Division of Air Quality.						Air Quality
A-10 Best Management Practice Objective: Prevent unnecessary or undue degradation of the lands and protect health. Requirement/Standard: This measure includes the following elements: a. Prior to initiation of a NEPA analysis for an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source (hereafter project), the authorizing officer (BLM) may require the project proponent to provide a minimum of one year of baseline ambient air monitoring data for any pollutant(s) of concern as determined by BLM if no representative air monitoring data are available for the project area, or existing representative ambient air monitoring data are insufficient, incomplete, or do not meet minimum air monitoring standards set by the Alaska DEC or the EPA. If BLM determines that baseline monitoring is required, this pre-analysis data must meet Alaska DEC and EPA air monitoring standards, and cover the year immediately prior to the submittal. Pre-project monitoring may not be appropriate where the life of the project is less than one year. b. The BLM may require monitoring for the life of the project depending on the magnitude of potential air emissions from the project, proximity to a federally mandated Class I area, sensitive Class II area (as identified on a case-by-case basis by Alaska DEC or a federal land management agency), or population center, location within or proximity to a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during NEPA undertaken for the project. c. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the project proponent shall prepare (and submit for BLM approval) an emissions inventory that includes quantified emissions of regulated air pollutants from all direct and indirect sources related to the proposed project, including reasonably foreseeable air pollutant emissions of criteria air pollutants, volatile organic compounds, hazardous air pollutants, and greenhouse gases estimated for each year for the life of the project. The BLM will use this estimated emissions inventory to identify pollutants of concern and to determine the appropriate level of air analysis to be conducted for the proposed project. d. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the BLM may require the proponent to provide an emissions reduction plan that includes a detailed description of operator committed measures to reduce project related air pollutant emissions including, but not limited to greenhouse gases mercury and other heavy metals, and fugitive dust. e. For an application to develop a central production facility, production pad/well, airstrip, road, gas compressor station, or other potential substantial air pollutant emission source, the authorized officer may require air quality modeling for purposes of analyzing project direct, indirect or cumulative impacts to air quality. The BLM may require air quality modeling depending on the magnitude of potential air emissions from the project or activity, duration of the proposed action, proximity to a federally mandated Class I area, sensitive Class II area (as identified on a case-by-case basis by Alaska DEC or a federal land management agency), or population center, location within a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during NEPA undertaken for the project. The BLM will determine the information required for a project specific modeling analysis through the development of a modeling protocol for each analysis. The authorized officer will consult with appropriate federal, State, and/or local agencies regarding modeling to inform his/her modeling decision and avoid duplication of effort. The modeling shall compare predicted						Air Quality

Commented [1]: added by Matz

impacts to all applicable local, State, and federal air quality standards and increments, as well as other scientifically defensible significance thresholds (such as impacts to air quality related values, incremental cancer risks, etc.). f. The BLM may require air quality mitigation measures and strategies within its authority (and in consultation with local, state, federal, and tribal agencies with responsibility for managing air resources) in addition to regulatory requirements and proponent committed emission reduction measures, and for emission sources not otherwise regulated by Alaska DEC or EPA, if the air quality analysis shows potential future impacts to NAAQS or AAAQS or impacts above specific levels of concern for air quality related values (AQRVs). g. If ambient air monitoring indicates that project-related emissions are causing or contributing to impacts that would cause unnecessary or undue degradation of the lands, cause exceedances of NAAQS, or fail to protect health (either directly or through use of subsistence resources), the authorized officer may require changes in activities at any time to reduce these emissions to comply with the NAAQS and/or minimize impacts to AQRVs. Within the scope of BLM's authority, the BLM may require additional emission control strategies to minimize or reduce impacts to air quality. h. (Alternative B-2 only) Publicly available reports on air quality baseline monitoring, emissions inventory, and modeling results developed in conformance with this best management procedure shall be provided by the project proponent to the North Slope Borough and to local communities and tribes in a timely manner.	

WINTER OVERLAND MOVES AND SEISMIC WORK				
Alternative B-1	Alternative B-2 Preferred Alternative	Alternative C	Alternative D	FWS Category
C-2 Best Management Practice Objective: Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation. Requirement/Standard: a. Ground operations shall be allowed only when frost and snow cover are at sufficient depths to protect the tundra. Ground operations shall cease when the spring snowmelt begins (approximately May 5 in the foothills area where elevations reach or exceed 500 feet and approximately May 15 in the northern coastal areas). The exact dates will be determined by the authorized officer. b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. Low-ground-pressure vehicles shall be selected and operated in a manner that eliminates direct impacts to the tundra by shearing, scraping, or excessively compacting the tundra mat. **Note**: This provision does not include the use of heavy equipment such as front-end loaders and similar equipment required during ice road construction. c. Bulldozing of tundra mat and vegetation, trails, or seismic lines is prohibited; however, on existing trails, seismic lines or camps, clearing of drifted snow is allowed to the extent that the tundra mat is not disturbed. d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles such as Rolligons. e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year. f. Motorized ground-vehicle use within the Colville River Special Area associated with overland moves, seismic work, and any similar use of heavy equipment shall be minimized within an area that extends 1 mile west or northwest of the bluffs of the Colville River, and 2 miles on either side of the Kogosukruk and Kikiakrorak rivers and tributaries of the Kogosukruk River from April 15 through August 5, with the exception that use will be minimized in the vicinity of gyrfalcon nests beginning March 15. Such use will remain 0.5 mile away from known raptor nesting sites, unless authorized by the authorized officer.				vegetation, birds
FACILITY DESIGN AND CONSTRUCTION				
E-9 Best Management Practice Objective: Avoidance of human-caused increases in populations of predators of ground-nesting birds. Requirement/Standard: a. Lessee shall utilize best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee shall provide the authorized officer with an annual report on the use of oil and gas facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites. b. Feeding of wildlife, and allowing wildlife to access human food or putrescible waste, is prohibited and will be subject to non-compliance regulations.				wildlife, birds
E-10 Best Management Practice Objective: Reduction of risk of collisions between migrating birds and oil and gas and related facilities during low light conditions. Requirement/Standard: Illumination of all structures between August 1 and October 31 shall be designed to direct artificial exterior lighting inward and downward, rather than upward and outward, unless otherwise required by the Federal Aviation Administration.				birds

Commented [1]: Requirement (f) is not relevant to the Coastal Plain and can be eliminated.

E-11 Best Management Practice Objective: Minimize the take of bird species, particularly those listed under the Endangered Species Act and BLM Special Status Species from direct or indirect interaction with oil and gas facilities. Requirement/Standard: In accordance with the guidance below, before the approval of facility construction, aerial surveys of the following species shall be conducted within any area proposed for development. ***Special Conditions in Spectacled and/or Steller's Eiders Habitats:*** a. Surveys shall be conducted by the lessee for at least 3 years before authorization of construction, if such construction is within the USFWS North Slope eider survey area and at least 1 year outside that area. Results of aerial surveys and habitat mapping may require additional ground nest surveys. Spectacled and/or Steller's eider surveys shall be conducted following accepted BLM-protocol. Information gained from these surveys shall be used to make infrastructure siting decisions as discussed in subparagraph b, below. b. If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall work with the USFWS and BLM early in the design process to site roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and their preferred habitats. Such consultation shall address timing restrictions and other temporary mitigating measures, location of permanent facilities, placement of fill, alteration of eider habitat, aircraft operations, and management of high noise levels. c. To reduce the possibility of spectacled and/or Steller's eiders ~~(and, under Alternatives B 1, B 2, and C only, other birds)~~ colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases which are to be few in number and limited in extent. Exceptions are limited to the following situations, and must be reported to the USFWS when exceptions are authorized: 1. Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad; 2. Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or 3. Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods.	birds

b5 - dp

[redacted]

Contiued E-11 Best Management Practice *Special Conditions in Yellow-billed Loon Habitats:*a. Aerial surveys shall be conducted by the lessee for at least 3 years before authorization of construction of facilities proposed for development which are within 1 mile of a lake 25 acres or larger in size. These surveys along shorelines of large lakes shall be conducted following accepted BLM protocol during nesting in late June and during brood rearing in late August.b. Should yellow-billed loons be present, the design and location of facilities must be such that disturbance is minimized. The default standard mitigation is a 1-mile buffer around all recorded nest sites and a minimum 1,625-foot (500-meter) buffer around the remainder of the shoreline. Development will generally be prohibited within buffers unless no other option exists. *Protections for Birds*. To reduce the possibility of birds colliding with above-ground utility lines (power and communication), such lines shall either be buried in access roads or suspended on vertical support members except in rare cases, which are to be few in number and limited in extent. Exceptions are limited to the following situations:1. Overhead power or communication lines may be allowed when located entirely within the boundaries of a facility pad;2. Overhead power or communication lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a vertical support member; or3. Overhead power or communication lines may be allowed in situations when human safety would be compromised by other methods.b. To reduce the likelihood of birds colliding with communication towers, towers should be located, to the extent practicable, on existing pads and as close as possible to buildings or other structures, and on the east or west side of buildings or other structures if possible. Support wires associated with communication towers, radio antennas, and other similar facilities, should be avoided to the extent practicable. If support wires are necessary, they should be clearly marked along their entire length to improve visibility to low-flying birds. Such markings shall be developed through consultation with the USFWS.	birds
E-15 Best Management Practice Objective: Prevent or minimize the loss of nesting habitat for cliff nesting raptors. Requirement/Standard: a. Removal of greater than 100 cubic yards of bedrock outcrops, sand, and/or gravel from cliffs shall be prohibited. b. Any extraction of sand and/or gravel from an active river or stream channel shall be prohibited unless preceded by a hydrological study that indicates no potential impact by the action to the integrity of the river bluffs.	birds
E-16 Best Management Practice Objective: Prevent or minimize the loss of raptors due to electrocution by powerlines. Requirement/Standard: Comply with the most up-to-date industry-accepted suggested practices for raptor protection on powerlines. Current accepted standards were published in "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006" in 2006 by the Avian Power Line Interaction Committee and are updated as needed.	birds
E-18 Best Management Practice Objective: Avoid and reduce temporary impacts to productivity from disturbance near Steller's and/or spectacled eider nests. Requirement/Standard: Ground-level activity (by vehicle or on foot) within 200 meters of occupied Steller's and/or spectacled eider nests, from June 1 through August 15, will be restricted to existing thoroughfares, such as pads and roads. Construction of permanent facilities, placement of fill, alteration of habitat, and introduction of high noise levels within 200 meters of occupied Steller's and/or spectacled eider nests will be prohibited. In instances where summer (June 1 through August 15) support/construction activity must occur off existing thoroughfares, USFWS-approved nest surveys must be conducted during mid-June prior to the approval of the activity. Collected data will be used to evaluate whether the action could occur based on employment of a 200-meter buffer around nests or if the activity would be delayed until after mid-August once ducklings are mobile and have left the nest site. The BLM will also work with the USFWS to schedule oil spill response training in riverine, marine, and inter-tidal areas that occurs within 200 meters of shore outside sensitive nesting/brood-rearing periods or conduct nest surveys. The protocol and timing of nest	birds

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Commented [5]: Cliff-nesting raptor habitat in the 1002 is so scarce this may not be needed, but it also shouldn't be a problem to comply with it. b5 - dp [redacted]

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surveys for Steller's and/or spectacled eiders will be determined in cooperation with the USFWS, and must be approved by the USFWS. Surveys should be supervised by biologists who have previous experience with Steller's and/or spectacled eider nest surveys.						
ENDANGERED SPECIES ACT—SECTION 7 CONSULTATION PROCESS						
J. The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that will contribute to the need to list such a species or their habitat. The BLM may require modifications to or disapprove a proposed activity 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 as amended, 16 USC § 1531 et seq., including completion of any required procedure for conference or consultation.						Wildlife, vegetation, birds
ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS						
Alternative B-1	**Alternative B-2 Preferred Alternative**			**Alternative C**	**Alternative D**	

K-4a Lease Stipulation/Best Management Practice – Goose Molting Area **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing, K-4a would be a best management practice. Objective: Minimize disturbance to molting geese and loss of goose molting habitat in and around lakes in the Goose Molting Area. Requirement/Standard (General): Within the Goose Molting Area no permanent oil and gas facilities, except for pipelines, will be allowed within 1 mile of the shoreline of goose molting lakes. (See Map 2-3K for the current location of these 1-mile setback areas.) No waiver, exception, or modification will be considered. Prior to the permitting of a pipeline in the Goose Molting Area, a workshop will be convened to determine the best corridor for pipeline construction in efforts to minimize impacts to wildlife and subsistence resources. The workshop participants will include but will not be limited to Federal, state, and North Slope Borough representatives. In addition, only "in field" roads will be authorized as part of oil and gas field development. Requirement/Standard (Exploration): In goose molting habitat area exploratory drilling shall be limited to temporary facilities such as ice pads, ice roads, and ice airstrips, unless the lessee demonstrates that construction of permanent facilities (outside the identified Goose Molting Restricted Surface Occupancy Areas) such as gravel airstrips, storage pads, and connecting roads is environmentally preferable. (Also see *Stipulation K-11* regarding allowable surface disturbance). In addition, the following standards will be followed for permitted activities:a. From June 15 through August 20 exploratory drilling and associated activities are prohibited. The intent of this rule is to restrict exploration drilling during the period when geese are present.b. Water extraction from any lake used by molting geese shall not alter hydrological conditions that could adversely affect identified goose-feeding habitat along lakeshore margins. Considerations will be given to seasonal use by operators (generally in winter) and geese (generally in summer), as well as recharge to lakes from the spring snowmelt.c. Oil and gas exploration activities will avoid alteration (e.g., damage or disturbance of soils, vegetation, or surface hydrology) of critical goose-feeding habitat types along lakeshore margins (grass/sedge/moss), as identified by the authorized officer in consultation with the USFWS. **SEE FULL TABLE 2.3 FOR COMPLETE STIPULATION/BMP**						birds
K-4b Best Management Practice – Brant Survey Area Objective: Minimize the loss or alteration of habitat for, or disturbance of, nesting and brood rearing brant in the Brant Survey Area. Requirement/Standard:a. Aerial surveys for brant nesting colonies and brood-rearing areas shall be conducted for a minimum of 2 years before authorization of construction of permanent facilities. At a minimum, the survey area shall include the proposed development site(s) (i.e., the footprint) and the surrounding 0.5-mile area. These surveys shall be conducted following accepted BLM protocol.b. Development may be prohibited or activities curtailed within 0.5 mile of all identified brant nesting colonies and brood-rearing areas identified during the 2-year survey.						birds
SUMMER VEHICLE TUNDRA ACCESS						

Commented [7]: I don't believe this applies to the 1002, so its inclusion provides no benefit to molting geese.

Commented [8]: Same as previous comment

L-1 Best Management Practice Objective: Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities. Requirement/Standard: On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Best management Practice C-2a. Permission for such use would only be granted after an applicant has: a. Submitted studies satisfactory to the authorized officer of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation. b. Submitted surveys satisfactory to the authorized officer of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.	wildlife, vegetation, water, birds

FACILITY DESIGN AND CONSTRUCTION				
Alternative B-1	**B-2**	**Alternative C**	**Alternative D**	FWS Category
E-7 Best Management Practice Objective: Minimize disruption of caribou movement and subsistence use. Requirement/Standard: Pipelines and roads shall be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in subsistence activities. Listed below are the accepted design practices: a. Above-ground pipelines shall be elevated a minimum of 7 feet as measured from the ground to the bottom of the pipeline at vertical support members. b. In areas where facilities or terrain may funnel caribou movement, ramps over pipelines, buried pipelines, or pipelines buried under roads may be required by the authorized officer after consultation with federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility). c. A minimum distance of 500 feet between pipelines and roads shall be maintained. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad. Where it is not feasible to separate pipelines and roads, alternative pipeline routes, designs and possible burial within the road will be considered by the authorized officer. d. Above-ground pipelines shall have a non-reflective finish.				caribou, subsistence
E-19 Best Management Practice Objective: Provide information to be used in monitoring and assessing wildlife movements during and after construction. Requirement/Standard: A representation, in the form of ArcGIS-compatible shape-files, of all new infrastructure construction shall be provided to the authorized officer. During the planning and permitting phase, shape-files representing proposed locations shall be provided. Within 6 months of construction completion, shape-files (within GPS accuracy) of all new infrastructure shall be provided. Infrastructure includes all gravel roads and pads, facilities built on pads, pipelines and independently constructed powerlines (as opposed to those incorporated in pipeline design). Gravel pads shall be included as polygon feature. Roads, pipelines, and powerlines may be represented as line features but must include ancillary data to denote width, number pipes, etc. Poles for power lines may be represented as point features. Ancillary data shall include construction beginning and ending dates.				caribou, wildlife
ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS				

K-5a Lease Stipulation/Best Management Practice –Caribou Summer Habitat **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-5a would be a best management practice. All lands within the Arctic Refuge Coastal Plain are recognized as summer habitat of the the Porcupine and Central Arctic caribou herds and shall be managed to ensure unhindered movement of caribou through the area. Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements through portions the Coastal Plain that are essential for summer use by caribou, including calving and rearing, insect-relief, and migration. Requirement/Standard: The following standards will be applied to permitted activities: a. Within the Arctic Refuge Coastal Plain, lessees shall orient linear corridors when laying out oil and gas field developments to avoid impeding caribou migration and to avoid corralling effects created by loops of road and/or pipeline that connect facilities. b. Ramps over pipelines, buried pipelines, or pipelines buried under the road may be required by the authorized officer, after consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies, where pipelines potentially impede caribou movement. c. Major construction activities using heavy equipment (e.g., sand/gravel extraction and transport, pipeline and pad construction, but not drilling from existing production pads) shall be suspended from May 20 through July 20, unless approved by the authorized officer in consultation with the appropriate federal, State, and North Slope Borough regulatory and resource agencies. The intent of this requirement is to restrict activities that will disturb caribou during calving and insect-relief periods. If caribou arrive on the calving grounds prior to May 20, major construction activities will be suspended. The lessee shall submit with the development proposal a "stop work" plan that considers this and any other mitigation related to caribou early arrival. The intent of this latter requirement is to provide flexibility to adapt to changing climate conditions that may occur during the life of fields in the region.	caribou
K-5a Lease Stipulation/Best Management Practice – Caribou Summer Habitat Continued d. The following ground and air traffic restrictions shall apply in the areas and time periods indicated. Ground traffic restrictions apply to permanent oil and gas-related roads: 1. From May 20 through July 20, traffic speed shall not exceed 15 miles per hour when caribou are within 0.5 mile of the road. Additional strategies may include limiting trips, using convoys, using different vehicle types, etc., to the extent practicable. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable. 2. The lessee or a contractor shall observe caribou movement from May 20 through July 20, or earlier if caribou are present prior to May 20. Based on these observations, traffic will be stopped: a. temporarily to allow a crossing by 10 or more caribou. Sections of road will be evacuated whenever an attempted crossing by a large number of caribou appears to be imminent. The lessee shall submit with the development proposal a vehicle use plan that considers these and any other mitigation. b. by direction of the authorized officer throughout a defined area for up to four weeks to prevent displacement of calving caribou. The vehicle use plan shall also include a vehicle-use monitoring plan. Adjustments will be required by the authorized officer if resulting disturbance is determined to be unacceptable. 3. Major equipment, materials, and supplies to be used at oil and gas work sites shall be stockpiled prior to or after the period of May 20 through July 20 to minimize road traffic during that period. 4. Aircraft use (including fixed wing and helicopter) shall be restricted in areas where caribou are present from May 20 through July 20 unless doing so endangers human life or violates safe flying practices. Authorized users of the NPR-A may be restricted from using aircraft larger than a Twin Otter, and limited to	caribou

an average of one fixed-wing aircraft takeoff and landing per day per airstrip, except for emergency purposes. Restrictions may include prohibiting the use of aircraft larger than a Twin Otter by authorized users of the NPR-A, including oil and gas lessees, from May 20 through July 20 in areas where caribou are present, except for emergency purposes. The lessee shall submit with the development proposal an aircraft use plan that considers these and other mitigation. The aircraft use plan shall also include an aircraft monitoring plan. Adjustments, including perhaps suspension of all aircraft use, will be required by the authorized officer if resulting disturbance is determined to be unacceptable. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.	
Continued ***K-5a Lease Stipulation/Best Management Practice –Caribou Summer Habitat*** 5. Aircraft shall maintain a minimum height of 1,000 feet above ground level (except for takeoffs and landings) from May 20 through July 20, unless doing so endangers human life or violates safe flying practices. This lease stipulation is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objective of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.	caribou

K-6 Lease Stipulation – Coastal Area (Alternatives B-1, C, and D) **Note:** This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-6 would be a best management practice. Objective: Minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; to protect the summer shoreline habitat for polar bears, walrus, and seals; to prevent contamination of marine waters; loss of important bird habitat; alteration or disturbance of shoreline marshes; and impacts to subsistence resources activities. Requirement/Standard: No permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines established to support exploration and development activities shall be located in the Coastal Area, which includes all barrier and offshore islands within the Arctic Refuge Coastal Plain and a coastal strip extending 0.75 mile inland from the coast. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, the Village of Kaktovik, and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope. In a case in which the BLM authorizes a permanent oil and gas facility within the Coastal Area, the lessee/permittee shall develop and implement a monitoring plan to assess the effects of the facility and its use on coastal habitat and use.	polar bears, caribou
K-6 Lease Stipulation – Coastal Area (Alternative B-2 only) Objective: Protect coastal waters and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; protect the summer and winter shoreline habitat for polar bears, and the summer shoreline habitat for walrus and seals; prevent loss of important bird habitat and alteration or disturbance of shoreline marshes; and prevent impacts to subsistence resources activities. Requirement/Standard:a. Exploratory well drill pads, production well drill pads, or a central processing facility for oil or gas would not be allowed in coastal waters or on islands between the northern boundary of the Refuge and the mainland, or in inland areas within one mile of the coast. Other facilities necessary for oil and gas production within the Refuge that necessarily must be within this area (e.g., barge landing, seawater treatment plant, or spill response staging and storage areas) would not be precluded. Nor would this stipulation preclude infrastructure associated with offshore oil and gas exploration and production or construction, renovation, or replacement of facilities on existing gravel sites. Lessees/permittees shall consider the practicality of locating facilities that necessarily must be within this area at previously occupied sites such as Distant Early Warning-Line sites. All lessees/permittees involved in activities in the immediate area must coordinate use of these new or existing sites with all other prospective users. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, the North Slope Borough, and local whaling captains' associations to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope. In a case in which the BLM authorizes a permanent oil and gas facility within the Coastal Area, the lessee/permittee shall develop and implement a monitoring plan to assess the effects of the facility and its use on coastal habitat and use.b. Marine vessels used as part of a BLM-authorized activity shall maintain a 1-mile buffer from the shore when transiting past an aggregation of seals (primarily spotted seals) using a terrestrial haulout unless doing so would endanger human life or violate safe boating practices. Marine vessels shall not conduct ballast transfers or discharge any matter into the marine environment within 3 miles of the coast except when necessary for the safe operation of the vessel.c. Marine vessels used as part of a BLM-authorized activity	polar bears, caribou

shall maintain a 0.5-mile buffer from shore when transiting past an aggregation of walrus using a terrestrial haulout.	
K-10 Best Management Practice – Porcupine Caribou Herd Calving Area Objective: Minimize disturbance and hindrance of caribou, or alteration of caribou movements in the south/southeast portion of the Coastal Plain that has been identified as important caribou habitat during calving, post-calving, and insect relief periods. Requirement/Standard: Within the Porcupine Caribou Calving Area, no areas will be offered for lease and no permanent oil and gas facilities will be allowed on the approximately 650,000 acres illustrated on Map --K and comprising the following townships: Township 3N, Ranges 34E-37E Township 4N, Ranges 31E-38E Township 5N, Ranges 31E-39E Township 6N, Ranges 32E-39E, and bounded on the south and east by the Mollie Beattie Wilderness Area.	caribou

K-11 Lease Stipulation – Porcupine Caribou Post Calving Habitat Area Objective: To protect key surface resources and subsistence resources/activities resulting from permanent oil and gas development and associated activities occurring in areas used by caribou during calving, post-calving, and insect relief periods . Requirement Standard: Permanent surface disturbance resulting from oil and gas activities is limited to 150 acres (approximately 0.65% of the area) within each of the following townships (Map ---K): Township 5N, Ranges 27E-30E Township 6N, Ranges 37E-31E This does not include surface disturbance activities from pipeline construction. A pipeline will be considered for development of one or more of these tracts after a workshop is convened to identify the best corridor for pipeline construction in efforts to minimize impacts to wildlife and subsistence resources. The workshop participants will include but need not be limited to Federal, state, and North Slope Borough representatives. (No alternative procedures will be approved).	caribou

Commented [1]: This value was mentioned by Kevin during the workshop and needs to be validated with supporting info

Commented [2]: This came directly from the NPR-A list: where infrastructure is allowed in the Teshekpuk caribou management area the acreage is limited to 0.6-0.7% of the lease sale area.

WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
A-1 Best Management Practice Objective: Protect the health and safety of oil and gas field workers and the general public by disposing of solid waste and garbage in accordance with applicable federal, State, and local law and regulations. Requirement/Standard: Areas of operation shall be left clean of all debris.				contaminants
A-2 Best Management Practice Objective: Minimize impacts on the environment from non-hazardous and hazardous waste generation. Encourage continuous environmental improvement. Protect the health and safety of oil and gas field workers and the general public. Avoid human-caused changes in predator populations. Requirement/Standard: Lessees/permittees shall prepare and implement a comprehensive waste management plan for all phases of exploration and development, including seismic activities. The plan shall be submitted to the authorized officer for approval, in consultation with federal, State, and North Slope Borough regulatory and resource agencies, as appropriate (based on agency legal authority and jurisdictional responsibility), as part of a plan of operations or other similar permit application. Management decisions affecting waste generation shall be addressed in the following order of priority: (1) prevention and reduction, (2) recycling, (3) treatment, and (4) disposal. The plan shall consider and take into account the following requirements: a. Methods to avoid attracting wildlife to food and garbage. The plan shall identify precautions that are to be taken to avoid attracting wildlife to food and garbage. b. Disposal of putrescible waste. Requirements prohibit the burial of garbage. Lessees and permitted users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the authorized officer. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility in accordance with EPA and Alaska Department of Environmental Conservation regulations and procedures. The burial of human waste is prohibited except as authorized by the authorized officer. c. Disposal of pumpable waste products. Except as specifically provided, the BLM requires that all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, Alaska Department of Environmental Conservation, and the Alaska Oil and Gas Conservation Commission regulations and procedures. On-pad temporary muds and cuttings storage, as approved by Alaska Department of Environmental Conservation, will be allowed as necessary to facilitate annular injection and/or backhaul operations. d. Disposal of wastewater and domestic wastewater. The BLM prohibits wastewater discharges or disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, unless authorized by a National Pollutant Discharge Elimination System or State permit.				contaminants, wildlife

A-3 Best Management Practice Objective: Minimize pollution through effective hazardous-materials contingency planning. Requirement/Standard: For oil- and gas-related activities, a hazardous materials emergency contingency plan shall be prepared and implemented before transportation, storage, or use of fuel or hazardous substances. The plan shall include a set of procedures to ensure prompt response, notification, and cleanup in the event of a hazardous substance spill or threat of a release. Procedures in the plan applicable to fuel and hazardous substances handling (associated with transportation vehicles) shall consist of best management practices if approved by the authorized officer. The plan shall include a list of resources available for response (e.g., heavy-equipment operators, spill-cleanup materials or companies), and names and phone numbers of federal, State, and North Slope Borough contacts. Other federal and State regulations may apply and require additional planning requirements. All appropriate staff shall be instructed regarding these procedures. In addition contingency plans related to facilities developed for oil production shall include requirements to: a. Provide refresher spill-response training to North Slope Borough and local community spill-response teams on a yearly basis. b. Plan and conduct a major spill-response field-deployment drill annually. c. Prior to production and as required by law, develop spill prevention and response contingency plans and participate in development and maintenance of the North Slope Subarea Contingency Plan for Oil and Hazardous Substances Discharges/Releases for the National Petroleum Reserve-Alaska operating area. Planning shall include development and funding of detailed (e.g., 1:26,000 scale) environmental sensitivity index maps for the lessee's/permittee's operating area and areas outside the lessee's/permittee's operating area that could be affected by their activities. (The specific area to be mapped shall be defined in the lease agreement and approved by the authorized officer in consultation with appropriate resource agencies.) Maps shall be completed in paper copy and geographic information system format in conformance with the latest version of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration's Environmental Sensitivity Index Guidelines. Draft and final products shall be peer reviewed and approved by the authorized officer in consultation with appropriate federal, State, and North Slope Borough resource and regulatory agencies.	contaminants

A-4 Best Management Practice Objective: Minimize the impact of contaminants on fish, wildlife, and the environment; including wetlands, marshes and marine waters; as a result of fuel, crude oil, and other liquid chemical spills. Protect subsistence resources and subsistence activities. Protect public health and safety. Requirement/Standard: Before initiating any oil and gas or related activity or operation, including field research/surveys and/or seismic operations, lessees/permittees shall develop a comprehensive spill prevention and response contingency plan per 40 CFR § 112 (Oil Pollution Act). The plan shall consider and take into account the following requirements: a. On-site Clean-up Materials. Sufficient oil-spill-cleanup materials (absorbents, containment devices, etc.) shall be stored at all fueling points and vehicle-maintenance areas and shall be carried by field crews on all overland moves, seismic work trains, and similar overland moves by heavy equipment. b. Storage Containers. Fuel and other petroleum products and other liquid chemicals shall be stored in proper containers at approved locations. Except during overland moves and seismic operations, fuel, other petroleum products, and other liquid chemicals designated by the authorized officer that in total exceed 1,320 gallons shall be stored within an impermeable lined and diked area or within approved alternate storage containers, such as over packs, capable of containing 110% of the stored volume. In areas within 500 feet of waterbodies, fuel containers are to be stored within appropriate containment. c. Liner Materials. Liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. d. Permanent Fueling Stations. Permanent fueling stations shall be lined or have impermeable protection to prevent fuel migration to the environment from overfills and spills. e. Proper Identification of Containers. All fuel containers, including barrels and propane tanks, shall be marked with the responsible party's name, product type, and year filled or purchased. f. Notice of Reportable Spills. Notice of any reportable spill (as required by 40 CFR § 300.125 and 18 AAC § 75.300) shall be given to the authorized officer as soon as possible, but no later than 24 hours after occurrence. g. Identification of Oil Pans (“duck ponds”). All oil pans shall be marked with the responsible party’s name.	contaminants
A-5 Best Management Practice Objective: Minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment. Requirement/Standard: Refueling of equipment within 500 feet of the active floodplain of any water body is prohibited. Fuel storage stations shall be located at least 500 feet from any water body with the exception of small caches (up to 210 gallons) for motor boats, float planes, ski planes, and small equipment, e.g., portable generators and water pumps, will be permitted. The authorized officer may allow storage and operations at areas closer than the stated distances if properly designed to account for local hydrologic conditions.	contaminants
A-6 Best Management Practice Objective: Minimize the impact on fish, wildlife, and the environment from contaminants associated with the exploratory drilling process. Requirement/Standard: Surface discharge of reserve-pit fluids is prohibited.	contaminants

A-11 Best Management Practice Objective: Ensure that permitted activities do not create human health risks through contamination of subsistence foods. Requirement/Standard: A lessee proposing a permanent oil and gas development shall design and implement a monitoring study of contaminants in locally-used subsistence foods. The monitoring study shall examine subsistence foods for all contaminants that could be associated with the proposed development. The study shall identify the level of contaminants in subsistence foods prior to the proposed permanent oil and gas development and monitor the level of these contaminants throughout the operation and abandonment phases of the development. If ongoing monitoring detects a measurable and persistent increase in a contaminant in subsistence foods, the lessee shall design and implement a study to determine how much, if any, of the increase in the contaminant in subsistence foods originates from the lessee's activities. If the study determines that a portion of the increase in contamination in subsistence foods is caused by the lessee's activities, the authorized officer may require changes in the lessee's processes to reduce or eliminate emissions of the contaminant. The design of the study/studies must meet the approval of the authorized officer. The authorized officer may consult with appropriate federal, State, and North Slope Borough agencies prior to approving the study/studies design. The authorized officer may require/authorize changes in the design of the studies throughout the operations and abandonment period, or terminate or suspend studies if results warrant.	contaminants, subsistence
A-12 Best Management Practice **NOTE: This best management practice is applicable only to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: To minimize negative health impacts associated with oil spills. Requirement/Standard: If an oil spill with potential impacts to public health occurs, the BLM, in undertaking its oil spill responsibilities, will consider: a. Immediate health impacts and responses for affected communities and individuals. b. Long-term monitoring for contamination of subsistence food sources. c. Long-term monitoring of potential human health impacts. d. Perceptions of contamination and subsequent changes in consumption patterns. e. Health promotion activities and communication strategies to maintain the consumption of traditional food.	contaminants, subsistence

Commented [1]: change to "must"

Commented [2]: Suggest that this BMP be for all alternatives.

OIL AND GAS EXPLORATORY DRILLING						
Alternative B-1	**Alternative B-2 Preferred Alternative**			**Alternative C**	**Alternative D**	FWS Category
D-2 Lease Stipulation Objective: Minimize surface impacts from exploratory drilling. Requirement/Standard: Construction of permanent or gravel oil and gas facilities shall be prohibited for exploratory drilling. Use of a previously constructed road or pad may be permitted if it is environmentally preferred.						operations
FACILITY DESIGN AND CONSTRUCTION						
E-4 Best Management Practice Objective: Minimize the potential for pipeline leaks, the resulting environmental damage, and industrial accidents. Requirement/Standard: All pipelines shall be designed, constructed, and operated under an authorized officer-approved quality assurance/quality control plan that is specific to the product transported and shall be constructed to accommodate the best available technology for detecting and preventing corrosion or mechanical defects during routine structural integrity inspections.						operations
E-5 Best Management Practice Objective: Minimize impacts of the development footprint. Requirement/Standard: Facilities shall be designed and located to minimize the development footprint and impacts to other uses of the Refuge. Issues and methods that are to be considered include: (a) use of maximum extended-reach drilling for production drilling to minimize the number of pads and the network of roads between pads; (b) sharing facilities with existing development; (c) collocation of all oil and gas facilities, except airstrips, docks, and seawater-treatment plants, with drill pads; (d) integration of airstrips with roads; (e) use of gravel- reduction technologies, e.g., insulated or pile-supported pads, (f) coordination of facilities with infrastructure in support of offshore development, (g) location of facilities and other infrastructure outside of areas identified as important for wildlife habitat, subsistence uses, recreational uses. **Note**: Where aircraft traffic is a concern, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.						operations

FACILITY DESIGN AND CONSTRUCTION						
Alternative B-1	**Alternative B-2 Preferred Alternative**			**Alternative C**	**Alternative D**	FWS Category
E-8 Best Management Practice Objective: Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources. Requirement/Standard: Gravel mine site design and reclamation will be in accordance with a plan approved by the authorized officer. The plan shall be developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies and consider: a. Locations outside the active floodplain. ~~and blahblahablah~~ b. Design and construction of gravel mine sites within active floodplains to serve as water reservoirs for future use. c. Potential use of the site for enhancing fish and wildlife habitat. d. Potential storage and reuse of sod/overburden for the mine site or at other disturbed sites on the North Slope. e.						water, reclamation

Commented [1]: This is common practice in the oilfields to the west and I believe will be required in the 1002 Area to provide water for domestic use, industrial production, and ice roads. The State has a couple of good technical papers on this practice with guidelines for development from gravel extraction to flooding and then long-term water reservoirs (McLean 1993; Ott et al. 2014)

Commented [2]: The State has done this in some of the flooded gravel pits btw the Sag and Colville but I think we want to prohibit this in the 1002 Area.

Commented [3]: All constructed water storage reservoirs shall be a sufficient distance from drill sites, fueling stations, or other temporary or permanent site that generates or maintains more than 220 gallons of fuel, drilling fluids, or other hazardous materials to avoid contamination via surface or groundwater of the storage reservoir. The lessee shall implement a water quality and contaminants monitoring program for any constructed water storage facility.

OIL AND GAS FIELD ABANDONMENT						
G-1 Lease Stipulation Objective: Ensure long-term reclamation of land to its previous condition and use. Requirement/Standard: Prior to final abandonment, land used for oil and gas infrastructure—including but not limited to well pads, production facilities, access roads, and airstrips—shall be reclaimed to ensure eventual restoration of ecosystem function and meet minimal standards for eligibility of Wilderness designation . The leaseholder shall develop and implement an abandonment and reclamation plan approved by the BLM. The plan shall describe short-term stability, visual, hydrological, and productivity objectives and steps to be taken to ensure eventual ecosystem restoration to the land's previous hydrological, vegetative, habitat condition, and Wilderness eligibility. The BLM may grant exceptions to satisfy stated environmental or public purposes.						reclamation

Commented [4]: It would be good to come up with an effective incentive for the companies to perform reclamation. Hard rock mineral mines put down a deposit, but the deposit is always insufficient for reclamation, and the companies commonly walk away after production and the public then pays for reclamation and long-term monitoring. If this is the extent of BLMs stipulation for NS Oil development, then the companies may simply walk away when they are done pumping oil. Is it possible to include a reclaim as you go provision or a significant financial incentive? I think we understand that gravel roads, pads, and gravel pits will never be completely reclaimed, but pipelines, buildings, vehicles, derricks, etc., should be removed.

WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY				
Alternative B-1	Alternative B-2	Alternative C	Alternative D	FWS Category
A-8 Best Management Practice Objective: Minimize conflicts resulting from interaction between humans and bears during oil and gas activities. Requirement/Standard: Oil and gas lessees, their contractors and subcontractors, and all other personnel associated with authorized oil and gas activities will, as a part of preparation of lease operation planning, prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These bear-interaction plans shall be developed in consultation with and approved by the U.S Fish & Wildlife Service and the Alaska Department of Fish and Game. The plans shall include specific measures to identify and establish: a. Methods and procedures to minimize attraction of bears to the work sites, e.g., bear resistant containers for all waste categories, waste handling, waste removal and disposal. b. The organization and layout of buildings and work sites to minimize human/bear interactions. c. Communication methods and procedures to warn personnel of bears near or on work sites. d. Identify and establish personnel, methods, procedures, and training, if authorized, to discourage bears from approaching the work site using passive and active, non-injurious, less-lethal methods. e. Identify and establish contingencies in the event bears do not leave the work site or cannot be discouraged by authorized personnel. f. Identify and establish methods and procedures for the proper storage and disposal of materials that may be attractive, or toxic, or both to bears, e.g., bear resistant waste containers. g. A systematic record of bears on the work site and in the immediate area. h. Methods, procedures, and training to identify and avoid known or observed polar bear dens by at least 1-mile, and grizzly bear dens by at least 0.5-mile, unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service, or the Alaska Department of Fish and Game, or both as appropriate. i. Methods and procedures to minimize disturbance to polar bear dens from oil and gas activities.				wildlife, polar bears
WINTER OVERLAND MOVES AND SEISMIC WORK				
The following required operating procedures/best management practices apply to overland and overice moves, seismic work, and any similar cross-country use of vehicles and heavy equipment on non-roaded surfaces during the winter season.				
C-1 Best Management Practice Objective: Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations. Requirement/Standard: a. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 0.5 mile of known or observed grizzly bear dens unless alternative protective measures are approved by the authorized officer in consultation with the Alaska Department of Fish and Game. b. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed polar bear dens unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service. c. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed seal birthing lairs unless alternative protective measures are approved by the authorized officer in consultation with the National Oceanographic and Atmospheric Administration. d. Between October 30 and April 15 of any year, operators working within polar bear denning, and seal birthing habitat, shall conduct a survey for polar bear dens and seal birthing lairs in consultation with the				polar bears, wildlife

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Commented [4]: Does this sound reasonable? I just want to make sure that we capture the fact that polar bear denning habitat isn't just along the coast in the 1002, but goes considerably further to the south

U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or both as appropriate, throughout the planned area of activities and before initiating activities.	
K-6 Lease Stipulation – Coastal Area (Alternative B-2 only) Objective: Protect coastal waters, lagoons, barrier islands, shorelines (Coastal Area), and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; minimize hindrance or alteration of polar bear utilization and movement in Coastal Area habitats; protect and minimize disturbance from oil and gas activities to Coastal Area habitats for polar bears and seals; prevent loss and alteration of important Coastal Area bird habitat; and prevent impacts to Coastal Area subsistence resources and activities. Requirement/Standard: a Permanent infrastructure for oil or gas activities is not allowed in the Coastal Area between the northern boundary of the Arctic National Wildlife Refuge and the mainland, and inland areas within 2-miles of the coast. Infrastructure that may be necessary for authorized oil and gas activities within these critical and sensitive Coastal Area habitats (e.g., barge landing, docks, spill response staging and storage areas, or pipelines) may be approved by the authorized officer on a case-by-case basis in consultation with the U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or both as appropriate. All lessees/permittees involved in authorized activities in the Coastal Area must coordinate construction and use infrastructure with all other prospective Refuge users or user groups. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, the North Slope Borough, and local whaling captains associations to minimize impacts to subsistence whaling, and other subsistence activities of the communities of the North Slope. In a case in which the BLM authorizes permanent oil and gas infrastructure within the Coastal Area, the lessee/permittee shall develop and implement an impact and conflict avoidance and monitoring plan to assess, minimize, and mitigate the effects of the infrastructure and its use on these Coastal Area habitats and their use by wildlife and people. b. Vessels used as part of a BLM-authorized activity shall be operated in a manner that minimizes disturbance to wildlife in the Coastal Area. Vessels shall maintain a 1-mile buffer from the shore when transiting past an aggregation of seals (primarily spotted seals) using a terrestrial haulout unless doing so would endanger human life or violate safe boating practices. Vessels shall maintain a 0.5 mile buffer from polar bears observed on land or ice, and shall avoid polar bears in the water by at least 100 yards unless doing so would endanger human life or violate safe boating practices. Vessels shall not conduct ballast transfers or discharge any matter into the marine environment within 3 miles of the coast except when necessary for the safe operation of the vessel.	polar bears, caribou, birds

Commented [5]: This is mostly just the language from the NPRA plan, but I could potentially make it more precise to just apply to those waters within the lagoon system adjacent to Kaktovik. That's predominantly where bears are during the fall and where bear-related tourism occurs

Commented [6]: This is mostly just the language from the NPRA plan, but I could potentially make it more precise to just apply to those waters within the lagoon system adjacent to Kaktovik. That's predominantly where bears are during the fall and where bear-related tourism occurs

K-6 Lease Stipulation – Coastal Area (Alternatives B-1, C, and D) **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-6 would be a best management practice. Objective: Minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; protect coastal waters, lagoons, barrier islands, shorelines (Coastal Area), and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals); to prevent contamination of the Coastal Area; loss of important bird habitat; alteration or disturbance of shoreline marshes; and impacts to subsistence resources activities. Requirement/Standard: Permanent infrastructure for oil or gas activities is not allowed in the Coastal Area between the northern boundary of the Arctic National Wildlife Refuge and the mainland, or inland areas within 2-miles of the coast. Infrastructure that may be necessary for authorized oil and gas activities within these critical and sensitive Coastal Area habitats (e.g., barge landing, docks, spill response staging and storage areas, or pipelines) may be approved by the authorized officer on a case-by-case basis in consultation with the U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or both as appropriate. All lessees/permittees involved in authorized activities in the Coastal Area must coordinate construction and use infrastructure with all other prospective Refuge users or user groups. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, the North Slope Borough, and local whaling captains associations to minimize impacts to subsistence whaling, and other subsistence activities of the communities of the North Slope. In a case in which the BLM authorizes permanent oil and gas infrastructure within the Coastal Area, the lessee/permittee shall develop and implement an impact and conflict avoidance and monitoring plan to assess, minimize, and mitigate the effects of the infrastructure and its use on these Coastal Area habitats and their use by wildlife and people. b. Vessels used as part of a BLM-authorized activity shall be operated in a manner that minimizes disturbance to wildlife in the Coastal Area. Vessels shall maintain a 1-mile buffer from the shore when transiting past an aggregation of seals (primarily spotted seals) using a terrestrial haulout unless doing so would endanger human life or violate safe boating practices. Vessels shall maintain a 0.5 mile buffer from polar bears observed on land or ice, and shall avoid polar bears in the water by at least 100 yards unless doing so would endanger human life or violate safe boating practices. Vessels shall not conduct ballast transfers or discharge any matter into the marine environment within 3 miles of the coast except when necessary for the safe operation of the vessel.	polar bears, caribou, birds
K-6 Lease Stipulation – River corridor Objective: Minimize disturbance to denning polar bears, and disturbance or alteration of key river and creek maternal denning habitat areas. Standard: a. From the coastline to 5 miles inland, no permanent oil and gas infrastructure shall be located within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakturuk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service. b. From the coastline to 5 miles inland, between October 30 and April 15 of any year, operators shall not conduct oil and gas activities within 1-mile of potential polar bear denning habitat on the Niguanak River, Katakturuk Creek, Nularvik Creek, Marsh Creek, Carter Creek, and Itkilyariak Creek unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service.	

Commented [7]: This is mostly just the language from the NPRA plan, but I could potentially make it more precise to just apply to those waters within the lagoon system adjacent to Kaktovik. That's predominantly where bears are during the fall and where bear-related tourism occurs

Commented [8]: This is mostly just the language from the NPRA plan, but I could potentially make it more precise to just apply to those waters within the lagoon system adjacent to Kaktovik. That's predominantly where bears are during the fall and where bear-related tourism occurs

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NOISE MITIGATION						
Objective: *Maintain soundscape component of wilderness characteristics within river/recreation buffers in their current condition by preserving a setting characterized by natural quiet and natural sounds.* Requirement/Standard: No surface occupancy allowed for coastal lagoons between the Kongakut River mouth to and including Kaktovik Lagoon; and along the Hulahula River and Canning Rivers; and limit occupation/infrastructure located outside of, but audible from within, these buffers to reduce noise potential. Use best practices for noise impact mitigation and innovate new methods to prevent to the extent practicable noise impacts within the buffers, including but not limited to: placing production facilities and aircraft landing areas outside sound range of the recreation buffer; and adopting/innovating construction methods that dampen sound transmission at any sites where sound is generated (such as at landing areas, production facilities, etc.). At the time of application for activities located outside of but audible from within said buffers, the lessee/permittee shall, after consultation with the authorized officer, submit a plan to best minimize noise impacts to recreation by attempting to maintain natural quiet and natural sounds. Development and implementation of baseline data collection protocols about current soundscape conditions and monitoring of noise impacts during activity will be a necessary element of the plan.						Recreation. Cross reference: subsistence, wildlife, Wilderness, recreation

Commented [1]: Noise in soundscape science is generally characterized as not naturally-occurring, so noise and sound are used in contrast here, without further explanation.

FACILITY DESIGN AND CONSTRUCTION						
						FWS Category
Objective: *Maintain visual component of wilderness characteristics within river/recreation buffers in their current condition by preserving scenic diversity of view and special features in a setting characterized by natural, undeveloped scenery and conditions.* Requirement/Standard: Buffers for no surface occupancy for coastal lagoons between the Kongakut River mouth to and including Kaktovik Lagoon; for no surface occupancy along the Hulahula River and Canning Rivers within the coastal plain; and limit development of new infrastructure located outside of, but visible from within, these buffers. For limited development of new infrastructure located outside of, but visible from within, these buffers, use best practices for designing and maintaining necessary infrastructure possibly visible from within buffers by adopting existing best practices in visual resource impact mitigation and innovating new methods to strive for no visual impact from within the buffers, including but not limited to: modeling visibility of infrastructure as seen from within the buffer during planning and development to locate and cap the height of temporary and permanent structures; identifying and locating the minimum number of roads, drill pads, pipelines, production facilities, etc.; and timing gas flare events to coincide with lower visitation times. Additionally, for limited development of new infrastructure located outside of, but visible from within, these buffers, manage permitted activities to meet Visual Resource Management class objectives described below. **Class I:** Natural ecological changes and very limited management activity are allowed. The level of change to the characteristic landscape should be very low and must not attract attention. **Class II:** The level of change to the characteristic landscape should be low. Management activities may be seen, but should not dominate the view of the casual observer. Any changes should repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. **Class III:** The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. **Class IV:** The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize impacts through location and design by repeating form, line, color, and texture. At the time of application for construction of facilities, the lessee/permittee shall, after consultation with the authorized officer, submit a plan for limited development of new infrastructure located outside of, but visible from within, these buffers, to best minimize visual impacts, consistent with the Visual Resource Management class for the lands on which facilities would be located and include reclamation methods that will be used to reduce visual impacts after facilities are removed. A photo simulation of the proposed facilities may be a necessary element of the plan.						Recreation. Cross reference: subsistence, WSRs, Reclamation
USE OF AIRCRAFT						

Objective *Minimize the effects of low-flying aircraft on recreational activities and the wildlife visitors come to view or harvest.* Requirement/Standard: The lessee shall ensure that aircraft maintain altitudes according to the following guidelines (**Note:** This best management practice is not intended to restrict flights necessary to gain information necessary to meet the stated objectives of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.): a. Aircraft shall maintain an altitude of at least X,XXX feet above ground level when within 0.25 mile of Kaktovik Lagoon when visitors viewing polar bears are present (August-October) and within 0.5 mile of Canning and Hulahula buffers during peak visitation (June 15-July 15; and fall general hunting), unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from the BLM necessary to plan flight routes when routes may go near primary recreation sites. b. An aircraft use plan must be pre-approved. The plan shall address strategies to minimize impacts to recreational activities (including wildlife watching and photography, hunting and fishing), including but not limited to the number of flights, type of aircraft, and flight altitudes and routes, and shall also include a plan to monitor flights. Proposed aircraft use plans should be reviewed by appropriate federal, State, and borough agencies. Consultations with these same agencies will be required if unacceptable disturbance is identified by Refuge users. Adjustments, including possible suspension of all flights, may be required by the authorized officer if resulting disturbance is determined to be unacceptable. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered where their distance from the recreation buffer results in no greater noise effect to allow larger aircraft to be employed, resulting in fewer flights to the facility. Where proximity of larger landing strips to the recreation buffer results in greater noise impacts, implement construction methods that mitigate the distance noise carries.. d. Use of aircraft, especially rotary wing aircraft, near recreation sites or during peak recreational periods (early summer river floating and fall caribou and moose hunting) or during peak recreational wildlife watching periods (spring birding and caribou migration and fall polar bear viewing) should be kept to a minimum.	Recreation. Cross reference: subsistence, wildlife, Wilderness, Polar bears, water and fish

Commented [2]: b5 - dp [redacted]

Commented [3]: Not sure if this is even possible considering the location of the airport but feel we should make some effort to address considering the community's expressed concerns about aircraft activity during polar bear viewing season.

Commented [4]: As originally written form NPRA, this would result in more noise.

RECREATION ACCESS and RECLAMATION OF FACILITIES						

Objective: *Maintain current level and methods for recreation access during leasing and production so unique recreational opportunities to experience challenge, self-reliance, and independence within a setting where enjoyment is earned through effort can continue to the extent possible.* Requirement/Standard: The lessee shall maintain the prohibition on use of helicopters for recreational access on Alaska Refuges (incidentally by the general public, or incidentally by industry workers on days off). The lessee shall ensure that aircraft used for permitted activities is limited to leasing activities, and does not incidentally support recreation by the general public, or by industry workers on days off, or otherwise directly or indirectly increase or diversify methods, locations, or temporal distribution of recreation access. The lessee shall minimize the effects on recreation access via float-plane by avoiding activities at or near lakes sizeable enough for float plane landings. Objective: *When leasing is complete, restore level and methods for recreation access that existed prior to leasing and production so that unique recreational opportunities to experience challenge, self-reliance, and independence within a setting where enjoyment is earned through effort can be restored.* Requirement/Standard: The lessee shall restore to former condition at the time leasing began any infrastructure that has the potential to increase or diversify methods, locations, or temporal distribution of recreation access or use (including but not limited to roads, landing areas, drill pads, and other surface modifications). At the time of application for activities, the lessee/permittee shall, after consultation with the authorized officer, develop and implement baseline data collection protocols for current recreational use located at the recreation buffer boundary as a necessary element of the plan.	Recreation. Cross reference: subsistence, wildlife, Wilderness, recreation

Commented [5]: "Maintaining current level of access and use" is a component of the recreation ORV and required for the Hulahula but I located this language related to access in recreation Stip Table because I see access as more gravitous for our recreation purpose and maintaining wilderness characteristics.

Commented [6]: Roger may want to suggest further edits to this section, and wants to see language about relative solitude, natural quiet and sound, and immersion in nature to flesh out the qualities...but I intended this section to be a tangible expression of how un-managed access activities could indirectly change such qualities.

Additional useful info:
Numerous laws, Departmental priorities, and originating Refuge purposes determine that recreation opportunities will be protectively managed:

- Section 5(d) of the Wild and Scenic Rivers Act (Public Law 90-542, as amended) establishes a method for providing Federal protection for certain free-flowing rivers and preserving them and their immediate environments for the use and enjoyment of present and future generations. The Wild and Scenic River considerations are a required element of comprehensive conservation plans and are conducted in accordance with the refuge planning process outlined in 602 FW 3.4C(1)(c) and (d), including public involvement and National Environmental Policy Act (NEPA) compliance.
- The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) gave guidance to the Secretary of the Interior for the overall management of the Refuge System. One of the Act's main components was identifying that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation are the priority general public uses of Refuges. In recent months the Secretary's priorities for hunting and fishing are emphasized throughout the Refuge System. Since 2010, the Refuge has hosted the nation's only federally-administered recreational polar bear viewing program on public lands. Numerous other "pinnacle" fishing and wildlife watching opportunities at specific locations would be protected by buffers suggested for polar bears, birds, caribou, etc.
- The original Refuge purpose of preserving "unique...recreational values" drives recreation management and prioritizes internationally unique opportunities to experience challenge, self-reliance, and independence within a setting characterized by natural, undeveloped conditions and extreme remoteness; while providing a degree of physical and psychological separation from reminders of modern civilization, and recreational enjoyment earned through effort (CCP Section 1.4.1.3), as well as other associated wilderness characteristics.

WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY						
Alternative B-1	**Alternative B-2 Preferred Alternative**			**Alternative C**	**Alternative D**	FWS Category
A-11 Best Management Practice Objective: Ensure that permitted activities do not create human health risks through contamination of subsistence foods. Requirement/Standard: A lessee proposing a permanent oil and gas development shall design and implement a monitoring study of contaminants in locally-used subsistence foods. The monitoring study shall examine subsistence foods for all contaminants that could be associated with the proposed development. The study shall identify the level of contaminants in subsistence foods prior to the proposed permanent oil and gas development and monitor the level of these contaminants throughout the operation and abandonment phases of the development. If ongoing monitoring detects a measurable and persistent increase in a contaminant in subsistence foods, the lessee shall design and implement a study to determine how much, if any, of the increase in the contaminant in subsistence foods originates from the lessee's activities. If the study determines that a portion of the increase in contamination in subsistence foods is caused by the lessee's activities, the authorized officer may require changes in the lessee's processes to reduce or eliminate emissions of the contaminant. The design of the study/studies must meet the approval of the authorized officer. The authorized officer may consult with appropriate federal, State, and North Slope Borough agencies prior to approving the study/studies design. The authorized officer may require/authorize changes in the design of the studies throughout the operations and abandonment period, or terminate or suspend studies if results warrant.						contaminants, subsistence
A-12 Best Management Practice **NOTE: This best management practice is applicable only to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: To minimize negative health impacts associated with oil spills. Requirement/Standard: If an oil spill with potential impacts to public health occurs, the BLM, in undertaking its oil spill responsibilities, will consider: a. Immediate health impacts and responses for affected communities and individuals. b. Long-term monitoring for contamination of subsistence food sources. c. Long-term monitoring of potential human health impacts. d. Perceptions of contamination and subsequent changes in consumption patterns. e. Health promotion activities and communication strategies to maintain the consumption of traditional food.						contaminants, subsistence
FACILITY DESIGN AND CONSTRUCTION						
E-1 Best Management PracticeObjective: Protect subsistence use and access to subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish and wildlife resources.Requirement/Standard: All roads must be designed, constructed, maintained, and operated to create minimal environmental impacts and to protect subsistence use and access to subsistence hunting and fishing areas. The authorized officer will consult with appropriate federal, State, and North Slope Borough regulatory and resources agencies prior to approving construction of roads. Subject to approval by the authorized officer, the construction, operation and maintenance of oil and gas field roads is the responsibility of the lessee unless the construction, operation, and maintenance of roads are assumed by the appropriate governing entity.						subsistence, wildlife

Commented [1]: change to "must"

E-3 Lease Stipulation Objective: Maintain free passage of marine and anadromous fish and protect subsistence use and access to subsistence hunting and fishing. Requirement/Standard: Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas. Causeways, docks, artificial islands, and bottom-founded drilling structures shall be designed to ensure free passage of marine and anadromous fish and to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics. A monitoring program, developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies, shall be required to address the objectives of water quality and free passage of fish.						fish, subsistence
E-7 Best Management Practice Objective: Minimize disruption of caribou movement and subsistence use. Requirement/Standard: Pipelines and roads shall be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in subsistence activities. Listed below are the accepted design practices: a. Above-ground pipelines shall be elevated a minimum of 7 feet as measured from the ground to the bottom of the pipeline at vertical support members. b. In areas where facilities or terrain may funnel caribou movement, ramps over pipelines, buried pipelines, or pipelines buried under roads may be required by the authorized officer after consultation with federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility). c. A minimum distance of 500 feet between pipelines and roads shall be maintained. Separating roads from pipelines may not be feasible within narrow land corridors between lakes and where pipelines and roads converge on a drill pad. Where it is not feasible to separate pipelines and roads, alternative pipeline routes, designs and possible burial within the road will be considered by the authorized officer. d. Above-ground pipelines shall have a non-reflective finish.						caribou, subsistence
E-13 Best Management PracticeObjective: Protect cultural and paleontological resources.Requirement/Standard: Lessees shall conduct a cultural and paleontological resources survey prior to any ground-disturbing activity. Upon finding any potential cultural or paleontological resource, the lessee or their designated representative shall notify the authorized officer and suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer.						cultural
USE OF AIRCRAFT FOR PERMITTED ACTIVITIES						

F-1 Best Management Practice Objective: Minimize the effects of low-flying aircraft on wildlife, subsistence activities, and local communities. Requirement/Standard: The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines (**Note:** This best management practice is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objectives of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.): a. Aircraft shall maintain an altitude of at least 1,500 feet above ground level when within 0.5 mile of cliffs identified as raptor nesting sites from April 15 through August 15 and within 0.5 mile of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from the BLM necessary to plan flight routes when routes may go near falcon nests. b. Aircraft shall maintain an altitude of at least 1,000 feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the authorized officer. The BLM will consult directly with the Alaska Department of Fish and Game in annually defining caribou winter ranges. c. Land user shall submit an aircraft use plan as part of an oil and gas exploration or development proposal. The plan shall address strategies to minimize impacts to subsistence hunting and associated activities, including but not limited to the number of flights, type of aircraft, and flight altitudes and routes, and shall also include a plan to monitor flights. Proposed aircraft use plans should be reviewed by appropriate federal, State, and borough agencies. Consultations with these same agencies will be required if unacceptable disturbance is identified by subsistence users. Adjustments, including possible suspension of all flights, may be required by the authorized officer if resulting disturbance is determined to be unacceptable. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered to allow larger aircraft to be employed, resulting in fewer flights to the facility. d. Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum.	subsistence, wildlife, Wilderness, recreation

Continued....F-1 Best Management Practicee. e. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Teshekpuk Lake Caribou Habitat Area (Maps 2-3K and2-4K, depending upon alternative) from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. Aircraft use (including fixed wing and helicopter) by oil and gas lessees in the Goose Molting Area (Maps 2-3K or 2-4K) should be minimized from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. f. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) over the Utukok River Uplands Special Area from May 20 through August 20, unless doing so would endanger human life or violate safe flying practices. (Note: The boundary of the Utukok River Uplands Special Area differs among Alternatives B-1 through D. See Maps 2-2, 2-3, and 2-4.) g. (Alternative B-2 only) Hazing of wildlife by aircraft is prohibited. Pursuit of running wildlife is hazing. If wildlife begins to run as an aircraft approaches, the aircraft is too close and must break away. h. (Alternative B-2 only) Fixed wing aircraft used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 2,000 feet and a 0.5-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. Helicopters used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 3,000 feet and a 1-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. i. (Alternative B-2 only) Aircraft used as part of a BLM-authorized activity along the coast and shore fast ice zone shall maintain minimum altitude of 3,000 feet and a buffer of 1 mile from aggregations of seals, unless doing so would endanger human life or violate safe flying practices.						subsistence, wildlife, Wilderness, recreation
SUBSISTENCE CONSULTATION FOR PERMITTED ACTIVITIES						
H-1 Best Management Practice Objective: Provide opportunities for participation in planning and decision making to prevent unreasonable conflicts between subsistence uses and other activities. Requirement/Standard: Lessee/permittee shall consult directly with affected communities using the following guidelines: a. Before submitting an application to the BLM, the applicant shall consult with directly affected subsistence communities, the North Slope Borough, and the National Petroleum Reserve-Alaska Subsistence Advisory Panel to discuss the siting, timing and methods of their proposed operations to help discover local traditional and scientific knowledge, resulting in measures that minimize impacts to subsistence uses. Through this consultation, the applicant shall make every reasonable effort, including such mechanisms as conflict avoidance agreements and mitigating measures, to ensure that proposed activities will not result in unreasonable interference with subsistence activities. In the event that no agreement is reached between the parties, the authorized officer shall consult with the directly involved parties and determine which activities will occur, including the timeframes. b. The applicant shall submit documentation of consultation efforts as part of its operations plan. Applicants should submit the proposed plan of operations to the National Petroleum Reserve-Alaska Subsistence Advisory Panel for review and comment. The applicant must allow time for the BLM to conduct formal government-to-government consultation with Native Tribal governments if the proposed action requires it. c. A plan shall be developed that shows how the activity, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. The plan will also describe the methods used to monitor the effects of the activity on subsistence use. The plan shall be submitted to the BLM as part of the plan of operations. The plan should address the following items: 1. A detailed description of the activity(ies) to take place (including the use of aircraft). 2. A description of how the lessee/permittee will minimize and/or deal with any potential impacts identified by the authorized officer during the consultation process.						subsistence

3. A detailed description of the monitoring effort to take place, including process, procedures, personnel involved and points of contact both at the work site and in the local community. 4. Communication elements to provide information on how the applicant will keep potentially affected individuals and communities up-to-date on the progress of the activities and locations of possible, short-term conflicts (if any) with subsistence activities. Communication methods could include holding community meetings, open house meetings, workshops, newsletters, radio and television announcements, etc. 5. Procedures necessary to facilitate access by subsistence users to conduct their activities. 6. (Alternative B-2 only) Barge operators requiring a BLM permit are required to demonstrate that barging activities will not have unmitigable adverse impacts on the availability of marine mammals to subsistence hunters. 7. (Alternative B-2 only) All vessels over 50 ft. in length engaged in operations requiring a BLM permit must have an Automatic Identification System (AIS) transponder system on the vessel. d. During development, monitoring plans must be established for new permanent facilities, including pipelines, to assess an appropriate range of potential effects on resources and subsistence as determined on a case-by-case basis given the nature and location of the facilities. The scope, intensity, and duration of such plans will be established in consultation with the authorized officer and NPR-A Subsistence Advisory Panel. e. Permittees that propose barging facilities, equipment, supplies, or other materials to NPR-A in support of oil and gas activities in the NPR-A shall notify, confer, and coordinate with the Alaska Eskimo Whaling Commission, the appropriate local community whaling captains' associations, and the North Slope Borough to minimize impacts from the proposed barging on subsistence whaling activities.	
H-2 Best Management Practice Objective: Prevent unreasonable conflicts between subsistence activities and geophysical (seismic) exploration. Requirement/Standard: In addition to the consultation process described in Best Management Practice H-1 for permitted activities, before activity to conduct geophysical (seismic) exploration commences, applicants shall notify the local search and rescue organizations of proposed seismic survey locations for that operational season. For the purpose of this standard, a potentially affected cabin/campsite is defined as any camp or campsite used for subsistence purposes and located within the boundary of the area subject to proposed geophysical exploration and/or within 1 mile of actual or planned travel routes used to supply the seismic operations while it is in operation. a. Because of the large land area covered by typical geophysical operations and the potential to impact a large number of subsistence users during the exploration season, the permittee/operator will notify all potentially affected subsistence-use cabin and campsite users. b. The official recognized list of subsistence-use cabin and campsite users is the North Slope Borough's most current inventory of cabins and campsites, which have been identified by the subsistence users' names. c. A copy of the notification letter, a map of the proposed exploration area, and the list of potentially affected users shall also be provided to the office of the appropriate Native Tribal government. d. The authorized officer will prohibit seismic work within 1 mile of any known subsistence-use cabin or campsite unless an alternate agreement between the cabin/campsite owner/user is reached through the consultation process and presented to the authorized officer. (Regardless of the consultation outcome, the authorized officer will prohibit seismic work within 300 feet of a known subsistence-use cabin or campsite.) e. The permittee shall notify the appropriate local search and rescue (e.g., Nuiqsut Search and Rescue, Atqasuk Search and Rescue) of their current operational location within the NPR-A on a weekly basis.	subsistence

This notification should include a map indicating the current extent of surface use and occupation, as well as areas previously used/occupied during the course of the operation in progress. The purpose of this notification is to allow hunters up-to-date information regarding where seismic exploration is occurring, and has occurred, so that they can plan their hunting trips and access routes accordingly. Identification of the appropriate search and rescue offices to be contacted can be obtained from the coordinator of the NPR-A Subsistence Advisory Panel in the BLM's Arctic Field Office.	
H-3 Best Management Practice Objective: Minimize impacts to sport hunting and trapping species and to subsistence harvest of those animals. Requirement/Standard: Hunting and trapping by lessee's/permittee' s employees, agents, and contractors are prohibited when persons are on "work status." Work status is defined as the period during which an individual is under the control and supervision of an employer. Work status is terminated when the individual's shift ends and he/she returns to a public airport or community (e.g., Fairbanks, Barrow, Nuiqsut, or Deadhorse). Use of lessee/permittee facilities, equipment, or transport for personnel access or aid in hunting and trapping is prohibited.	subsistence
I-1 Best Management Practice Objective: Minimize cultural and resource conflicts. Requirement/Standard: All personnel involved in oil and gas and related activities shall be provided information concerning applicable stipulations, best management practices, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. The lessee/permittee shall ensure that all personnel involved in permitted activities shall attend an orientation program at least once a year. The proposed orientation program shall be submitted to the authorized officer for review and approval and should:	subsistence, cultural, wildlife

a. provide sufficient detail to notify personnel of applicable stipulations and best management practices as well as inform individuals working on the project of specific types of environmental, social, traditional and cultural concerns that relate to the region. b. Address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals, and provide guidance on how to avoid disturbance. c. Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species. d. Be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating .e. Include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation. f. Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low-flying aircraft. Of special concern is aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall caribou and moose hunting seasons, and flights near North Slope communities. g. Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site. h. Include on-site records of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee. i. Include a module discussing bear interaction plans to minimize conflicts between bears and humans .j. Provide a copy of 43 CFR 3163 regarding Non-Compliance Assessment and Penalties to on-site personnel. k. Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. This training should be offered to the North Slope Borough Health Department for review and comment.l. Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities. This training should be offered to the North Slope Borough Health Department for review and comment.	

WINTER OVERLAND MOVES AND SEISMIC WORK				
Alternative B-1	**Alternative B-2**	**Alternative C**	**Alternative D**	FWS Category
C-2 Best Management Practice Objective: Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation. Requirement/Standard: a. Ground operations shall be allowed only when there is at least 12 inches of ground frost and 6 inches of snow on the coastal plain and 9 inches of snow cover in the foothills or there is ~~are at sufficient depths to protect the tundra~~. Ground operations shall cease when the spring snowmelt begins (approximately May 5 in the foothills area where elevations reach or exceed 500 feet and approximately May 15 in the northern coastal areas). The exact dates will be determined by the authorized officer. b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. Low-ground-pressure vehicles shall be selected and operated in a manner that eliminates direct impacts to the tundra by shearing, scraping, or excessively compacting the tundra mat. **Note**: This provision does not include the use of heavy equipment such as front-end loaders and similar equipment required during ice road construction. c. Bulldozing of tundra mat and vegetation, trails, or seismic lines is prohibited; however, on existing trails, seismic lines or camps, clearing of drifted snow is allowed to the extent that the tundra mat is not disturbed. d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. This provision does not apply to hardened snow trails for use by low-ground-pressure vehicles such as Rolligons. e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year. ~~f. Motorized ground vehicle use within the Colville River Special Area associated with overland moves, seismic work, and any similar use of heavy equipment shall be minimized within an area that extends 1 mile west or northwest of the bluffs of the Colville River, and 2 miles on either side of the Kogosukruk and Kikiakrorak rivers and tributaries of the Kogosukruk River from April 15 through August 5, with the exception that use will be minimized in the vicinity of gyrfalcon nests beginning March 15. Such use will remain 0.5 mile away from known raptor nesting sites, unless authorized by the authorized officer.~~				vegetation, birds
ENDANGERED SPECIES ACT—SECTION 7 CONSULTATION PROCESS ***J.***The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that will contribute to the need to list such a species or their habitat. The BLM may require modifications to or disapprove a proposed activity 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 as amended, 16 USC § 1531 et seq., including completion of any required procedure for conference or consultation.				Wildlife, vegetation, birds
ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS				

~~***K-8a Lease Stipulation – Pik Dunes***~~ ~~**Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-8a would be a best management practice.~~ ~~Objective: Retain unique qualities of the Pik Dunes, including geologic and scenic uniqueness, insect-relief habitat for caribou, and habitat for several uncommon plant species.~~ ~~Requirement/Standard: Surface structures, except approximately perpendicular pipeline crossings and ice pads, are prohibited within the Pik Dunes.~~	vegetation
SUMMER VEHICLE TUNDRA ACCESS ***L-1 Best Management Practice*** Objective: Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities. Requirement/Standard: On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Best management Practice C-2a. Permission for such use would only be granted after an applicant has:a. Submitted studies satisfactory to the authorized officer of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation.b. Submitted surveys satisfactory to the authorized officer of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.	wildlife, vegetation, water, birds
M-2 Best Management Practice **NOTE**: **This best management practice is applicable only to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: Prevent the introduction, or spread, of non-native, invasive species in the NPR-A. Requirement/Standard: Certify that all equipment and vehicles (intended for use either off or on roads) are weed-free prior to transporting them into the NPR-A. Monitor annually along roads for non-native invasive species, and initiate effective weed control measures upon evidence of their introduction. Prior to operations in the NPR-A, submit a plan for the BLM's approval, detailing the methods for cleaning equipment and vehicles, monitoring for weeds and weed control, including aquatic plants. Prevent the spread of non-native animal species, especially aquatic organisms. Prior to operations in the Coastal Plain, submit a plan for approval detailing methods for staging, operating, and cleaning equipment and vehicles, including boats, ~~boats~~, that avoids and minimizes the introduction and spread of invasive species. The plan should address both aquatic and terrestrial plants and animals. The plan should also provide details related to the monitoring and controls of non-native species~~.~~	Vegetation, wildlife

M-3 Best Management Practice **NOTE**: **This best management practice is applicable only to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: Minimize loss of populations of, and habitat for, plant species designated as Sensitive by the BLM in Alaska. Requirement/Standard: If a development is proposed in an area that provides potential habitat for a BLM Sensitive Plant Species, the development proponent would conduct surveys at appropriate times of the summer season and in appropriate habitats for the Sensitive Plant Species that might occur there. The results of these surveys will be submitted to the BLM with the application for development.	vegetation

WATER USE FOR PERMITTED ACTIVITIES				
Alternative B-1	**Alternative B-2 Preferred Alternative**	**Alternative C**	**Alternative D**	FWS Category
B-1 Best Management Practice Objective: Maintain populations of, and adequate habitat for, fish and invertebrates. Requirement/Standard: Withdrawal of unfrozen water from rivers and streams during winter is prohibited. The removal of ice aggregate from grounded areas ≤4-feet deep may be authorized in consultation with the FWS from rivers on a site- specific basis.				water
B-X1 Best Management Practice-Perennial Springs Objective: Maintain populations of, and adequate habitat for, fish and invertebrates. Requirement/Standard: Withdrawal of water from springs, upwelling, and shallow groundwater is prohibited. Withdrawal of water or ice aggregate from aufeis is prohibited.				
B-X Best Management Practice-Rivers and Streams Objective: Maintain populations of, and adequate habitat for, fish and invertebrates. Requirement/Standard: Water withdrawal from rivers and streams will be managed to ensure adequate water quality and quantity are maintained for all life stages of fish and invertebrates and to ensure that migration is not impaired.				

Commented [1]: ANILCA:
(i) to conserve fish and wildlife populations and habitats in their natural diversity
(iv) to ensure, to the maximum extent practicable and in a manner consistent wi h the purposes set for h in paragraph (i), water quality and necessary water quan ity within the refuge

Commented [2]: Do we need to define "winter". Concerned withdrawdown goinginto winter leading to deeper freezing level.

B-2 Best Management Practice Objective: Maintain natural hydrologic regimes in soils surrounding lakes and ponds, and maintain populations of, and adequate habitat for, fish, invertebrates, and waterfowl Requirement/Standard: Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas ≤4-feet deep may be authorized on a site-specific basis depending on water volume and depth and the waterbody's fish community. Current water use requirements are: a. Lakes with sensitive fish (i.e., any fish except ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 15% of calculated volume deeper than 7 feet; only ice aggregate may be removed from lakes that are ≤7-feet deep. b. Lakes with only non-sensitive fish (i.e., ninespine stickleback or Alaska blackfish): unfrozen water available for withdrawal is limited to 30% of calculated volume deeper than 5 feet; only ice aggregate may be removed from lakes that are ≤5. c. Lakes with no fish present, regardless of depth: water available for use is limited to 35% of total lake volume. d. In lakes where unfrozen water and ice aggregate are both removed, the total use shall not exceed the respective 15%, 30%, or 35% volume calculations. e. Additional modeling or monitoring may be required to assess water level and water quality conditions before, during, and after water use from any fish-bearing lake or lake of special concern. f. Any water intake structures in fish bearing or non-fish bearing waters shall be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury. Note: All water withdrawal equipment must be equipped and must utilize fish screening devices approved by the Alaska Department of Fish and Game, Division of Habitat. g. Compaction of snow cover or snow removal from fish-bearing waterbodies shall be prohibited except at approved ice road crossings, water pumping stations on lakes, or areas of grounded ice. h. Additional modeling and monitoring of lake recharge may be required to to ensure natural hydrologic regime, water quality, and aquatic habitat for migratory birds is maintained.	water
WINTER OVERLAND MOVES AND SEISMIC WORK	
C-3 Best Management Practice Objective: Maintain natural spring (break-up) runoff patterns and fish passage, avoid flooding, prevent streambed sedimentation and scour, protect water quality and protect stream banks. Requirement/Standard: Crossing of waterway courses shall be made using a low-angle approach. Crossings that are reinforced with additional snow or ice ("bridges") shall be removed, breached, or slotted before spring breakup. Ramps and bridges shall be substantially free of soil and debris.	water
C-4 Best Management Practice Objective: Avoid additional freeze-down of aquatic habitat ~~deep water pools~~ harboring over-wintering fish and invertebrates used by fish. Requirement/Standard: Travel up and down streambeds is prohibited unless it can be demonstrated that there will be no additional impacts from such travel to over-wintering fish or the invertebrates and water quality they rely on. Rivers, streams, and lakes shall be crossed at areas of grounded ice or with the approval of the authorizing officer and it has been demonstrated no addition impacts will occur to fish or invertebrates. ~~whenever possible.~~	water

Commented [3]: I hink this original language makes more sense than the modified text that was here.

Commented [4]: Technical question: Do "C-x" BMPs only apply to "WINTER OVERLAND MOVES AND SEISMIC WORK" or is this just where they would generally apply. Some of these BMPs would also apply to winter exploration and drilling, or o her winter operations.

C-5 Best Management Practice ~~**NOTE: This best management practice is only applicable to Alternative B-2. There would be no comparable provision for any of the other alternatives.**~~ Objective: Minimize the effects of high-intensity acoustic energy from seismic surveys on fish. Requirement/Standard: a. Seismic surveys will not be conducted over unfrozen water with fish overwintering potential. ~~a. When conducting vibroseis-based surveys above potential fish overwintering areas (water 6 feet deep or greater, ice plus liquid depth), operators shall follow recommendations by Morris and Winters (2005): only a single set of vibroseis shots should be conducted if possible; if multiple shot locations are required, these should be conducted with minimal delay; multiple days of vibroseis activity above the same overwintering area should be avoided if possible.~~ b. When conducting air gun-based surveys in freshwater, operators shall follow standard marine mitigation measures that are applicable to fish (e.g., Minerals Management Service 2006): operators will use the lowest sound levels feasible to accomplish their data-collection needs; ramp-up techniques will be utilized (ramp-up involves the gradual increase in emitted sound levels beginning with firing a single air gun and gradually adding air guns until the desired operating level of the full array is obtained). c. Explosive-based surveys are prohibited. ~~When conducting explosive-based surveys, operators shall follow setback distances from fish-bearing waterbodies based on requirements outlined by Alaska Department of Fish and Game (1991).~~	fish
OIL AND GAS EXPLORATORY DRILLING	
D-1 Lease Stipulation Objectives: Protect fish-bearing rivers, streams, and lakes from blowouts and minimize alteration of riparian habitat. Ensure water quality and protect aquatic and riparian habitat. Requirement/Standard: Exploratory drilling is prohibited in lakes, or rivers and streams as determined by the active floodplain, upper extent of the wet meadow zone. ~~and fish-bearing lakes.~~	fish
FACILITY DESIGN AND CONSTRUCTION	
E-2 Lease Stipulation Objective: Protect water quality and the diversity of fish, invertebrates and wildlife populations and habitats. Protect fish-bearing waterbodies, water quality, and aquatic habitats. Requirement/Standard: Permanent oil and gas facilities, including roads, airstrips, and pipelines, are prohibited upon or within 500 feet as measured from the ordinary high watermark of fish-bearing waterbodies. Essential pipeline and road crossings will be permitted on a case-by-case basis. **Note**: Also refer to Area-Specific Stipulations and Best Management Practices for Rivers Area (*Lease Stipulation K-1*) and Deep Water Lakes (*Lease Stipulation K-2*). Construction camps are prohibited on frozen lakes and river ice. Siting of construction camps on river sand and gravel bars is allowed and encouraged. Where leveling of trailers or modules is required and the surface has a vegetative mat, leveling shall be accomplished through blocking rather than use of a bulldozer.	water, fish

Commented [5]: Check with Jon K. on appropriate BMPs.

E-x Lease Stipulation Objective: Maintain surface water hydrology across the landscape to ensure vegetative communities are protected. Requirement/Standard: Infrastructure (roads, pipelines, airstrips, pads….) should be designed and built to minimize the disturbance to surface water hydrology (ie: sheetflow), minimize ponding and drying, protect from erosion and decreasing slope stability, and infrastructure washout.	vegetation
E-3 Lease Stipulation Objective: Maintain free passage of marine and anadromous fish and protect subsistence use and access to subsistence hunting and fishing. Requirement/Standard: Causeways and docks are prohibited in river mouths or deltas. Artificial gravel islands and bottom-founded structures are prohibited in river mouths or active stream channels on river deltas. Causeways, docks, artificial islands, and bottom-founded drilling structures shall be designed to ensure free passage of marine and anadromous fish and to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics. A monitoring program, developed in consultation with appropriate federal, State, and North Slope Borough regulatory and resource agencies, shall be required to address the objectives of water quality and free passage of fish.	fish, subsistence lagoons
E-8 Best Management Practice Objective: Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources. Requirement/Standard: Gravel mine site design and reclamation will be in accordance with a plan approved by the authorized officer. The plan shall be developed in consultation with appropriate federa Arctic NWR, State, and North Slope Borough regulatory and resource agencies and consider: a. Locations outside the active floodplain. b. Design and construction of gravel mine sites to serve as water reservoirs for future use may not be considered within active floodplains of the four rivers that support populations of freshwater, anadromous, or endemic fish (Canning, Sadlerochit, Hulahula, and Aichilik rivers). c. Potential storage and reuse of sod/overburden for the mine site or at other disturbed sites on the North Slope. d. Fish will not be introduced by people into flooded gravel mines designed as water reservoirs.	water, reclamation

Commented [6]: This is a design/engineering challenge when working in areas with topographic relief in arctic conditions. two fold- maintain landcover, and infrastructure stability.

Commented [7]: this leads to a larger question of stocking or introducing fish into to reservoirs?

Commented [8]: can we be specific throughout and add USFWS, Arctic NWR

Commented [9]: the discussion at the workshop indicated hese reservoirs were poten ially fish traps, more recent literature indicates they are now better designed to enhance fisheries, if done and managed appropriately.

E-14 Best Management Practice Objective: Ensure the passage of fish and unimpeded recreational use of rivers at stream crossings. Requirement/Standard: To ensure fish passage and passage of other organisms bridges are preferred over culverts. To ensure that crossings provide for fish passage, all proposed crossing designs shall adhere to the best management practices outlined in "Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings" U.S. Forest Service. 2008, ~~"Stream Crossing Design Procedure for Fish Streams on the North Slope Coastal Plain" by McDonald et al. (1994), "Fundamentals of Culvert Design for Passage of Weak Swimming Fish" by Behlke et al. (1991)~~, and other generally accepted best management procedures prescribed by the authorized officer. To adhere to these best management practices, at least 3 years of hydrologic and fish data shall be collected by the lessee for any proposed crossing of a stream whose structure is designed to occur, wholly or partially, below the stream's ordinary high watermark. These data shall include, but are not limited to, the range of water levels (highest and lowest) at the location of the planned crossing, and the seasonal distribution and composition of fish populations using the stream.	water, fish, recreation
ADDITIONAL PROTECTIONS THAT APPLY IN SELECT BIOLOGICALLY SENSITIVE AREAS	

Commented [10]: The BMPs USFWS is recommendig in AK have not been published yet, ADFG and engineering reviews are due next week.

Commented [11]: not sure how prescriptive we need to be .

K-x1 Lease Stipulation/Best Management Practice – Springs/Aufeis

Note: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternatives, K-x1 would be a best management practice.

Objective: Protect the water quality, quantity and diversity of fish and wildlife habitats and populations associated with springs and aufeis across the coastal plain. River systems with springs provide year round habitat and host the most diverse and largest populations of fish, invertebrates, and wildlife and are associated with major subsistence activity and cultural resources. Aufeis is a unique feature associated with perennial springs and helps sustain river flow during summer and provides insect relief for caribou. Because the subsurface flow paths to perennial springs are unknown and could potentially be disturbed by drilling or fracking activity, we recommend buffer areas around the major perennial springs that support fish populations in which no leasing is permitted.

Requirement/Standard:

aa. Prior to drilling activities subsurface flow paths are mapped and drilling activities will conducted in a manner that does not disrupt flow of the perennial springs.

a. Sadlerochit Spring is a habitat of special significance on the refuge. It supports an isolated, dwarf population of Dolly Varden, unique plant and invertebrate communities, and an extensive aufeis field that persists through much of the summer. No leasing should be permitted within 3 miles of Sadlerochit Spring. Additionally, there should be no surface occupancy within 3 miles of the Sadlerochit Spring or the aufeis field that forms each winter downstream.

b. The perennial spring at Fish Hole 1 on the Hulahula River provides overwintering habitat for Arctic grayling and a large population of anadromous Dolly Varden. Residents of Kaktovik routinely harvest Dolly Varden in Fish Hole 1 during winter. The spring produces an extensive aufeis field that persists through much of the summer. No leasing should be permitted within 3 miles of the Fish Hole 1 spring. Additionally, there should be no surface occupancy within 3 miles of the Fish Hole 1 spring or the aufeis field that forms each winter downstream.

c. The Canning River is the largest river crossing the 1002 Area and has several perennial springs originating upstream from the 1002 Area that provide steady flow under ice across the coastal plain. The river supports several fish species including Arctic grayling and a large population of anadromous Dolly Varden. Aufeis fills the river corridor across the coastal plain and extends well into the delta, providing insect relief to Caribou during the early summer. No surface occupancy within 2 miles of the eastern bank of the Canning River including through the delta.

d. Tamayariak Spring is the only perennial spring in the Tamayariak River within the 1002 Area. It is possible that some Arctic grayling and juvenile Dolly Varden overwinter in the spring, but that is not certain. It does produce an associated aufeis field; no surface occupancy within 2 miles.

Commented [12]: Might be good to say that if drilling activities occur within X number of miles of an anadromous water or a spring that quantification of ground water flow paths is required or no leasing will be permitted.

e. Okerokavik Spring is the only perennial spring in the Jago River drainage but is not know to support overwintering fish. It does produce an associated aufeis field; no surface occupancy within 2 miles.	

K-x2 Lease Stipulation/Best Management Practice –Canning, Hulahula, and Aichilik Rivers

Note: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternatives, K-x1 would be a best management practice.

Objective: Protect the water quality and quantity necessary to support the resident and anadromous fish populations that occupy these three rivers. Avoid disruption of free passage of fish between spawning, rearing or over-wintering habitats. Minimize the disruption of natural flow patterns and the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas. The Canning, Hulahula, and Aichilik rivers are the three rivers crossing the 1002 Area that support large populations of freshwater and anadromous fishes. Thus, these rivers require greater protective measures than the other drainages in the area.

Requirement/Standard: Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the streambed and adjacent to the rivers listed below at the distances identified. Gravel mines are prohibited within the active floodplain consistent with Best Management Practice E-8). On a case-by case basis, and in consultation with federal, USFWS, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility), essential pipeline and road crossings to the main channel will be permitted through setback areas.

a. Aichilak River setback will extend 3 miles from the eastern edge of the coastal plain boundary along the Aichilak River.

b. Hulahula River setback will be 3 miles in all directions from the active flood plain. Additional protective measures around the perennial spring at Fish Hole 1 are detailed in the previous section.

c. Canning River setback will extend from the western boundary of the 1002 Area to 3 miles east of the eastern edge of the active flood plain.

Commented [13]: Since this is the fish section I think we need to limit our discussion here to issues related to fish. It becomes too ponderous and disjointed to include everything else at the same time. The reason we are focusing on these three rivers and not the others is that they are the only hree rivers wi h big populations of anadromous fish. The 3 mile setback should protect the riparian zone from disturbance yet allow directional drilling to reach under the area if necessary.

K-x2 Lease Stipulation/Best Management Practice – other Rivers **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternatives, K-x1 would be a best management practice. Objective: Protect the water quality and quantity necessary to support the resident and seasonal fish populations that occupy these rivers and streams. Avoid disruption of free passage of fish among seasonal habitats. Minimize the disruption of natural flow patterns and the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas. Rivers and streams covered under this BMP include the Tamayariak, Katakturuk, Nularvik, Sadlerochit, Okpilak, Jago, Okerokovik, Niguanak, Sikrelurak, Angun, and Kogotpak rivers, and Marsh, Carter, and Itkilyariak creeks. The Tamayariak and Okpilak rivers share deltas with the Canning and Hulahula rivers, respectively, and some juvenile and freshwater fishes occupy them seasonally. The Sadlerochit River supports populations of Arctic grayling and resident dwarf Dolly Varden, but not anadromous Dolly Varden. The other rivers do not support fish through winter, although small numbers of fish may be encountered in them during summer. Requirement/Standard: Except were specifically stated below, permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the streambed and within 0.5 miles of the active flood plain from the southern boundary of the 1002 Area to the stream mouth. For streams located entirely within the 1002 Area, the setback extends to the head of the stream as identified in the National Hydrography Dataset. Floodplain gravel mines designed to become water reservoirs will be considered on a case-by-case basis consistent with Best Management Practice E-8. On a case-by case basis, and in consultation with USFWS, other federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility), essential pipeline and road crossings to the main channel will be permitted through setback areas. The above setbacks may not be practical within river deltas. In these situations, permanent facilities shall be designed to withstand a 200-year flood event. a.: Because of the unique nature of the resident populations of Arctic grayling and dwarf Dolly Varden within the drainage, the setback for the Sadlerochit River is widened to 1 mile and gravel mines intended to be water reservoirs are prohibited in the floodplain. There is an additional setback of 3 miles around the perennial Sadlerochit Spring as detailed in a previous section.	

K-x3 Lease Stipulation/Best Management Practice – Canning River Delta-lakes Objective: In the Canning River delta Protect and minimize adverse effects to the water quality, quantity and diversity of fish and wildlife habitats and populations, subsistence resources, cultural resources and Protect and minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of passage, spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of migratory bird habitat; Requirement/Standard: Prohibit permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, within 0.5 mile of the ordinary high watermark of any waterbody within townships 8 and 9 north of the Canning and Tamayariak watersheds. Generally, permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited on the lake or lakebed and within 0.25 mile of the ordinary high watermark. On a case-by-case basis in consultation with FWS, federal, State and North Slope Borough regulatory and resource agencies (as appropriate based on agency legal authority and jurisdictional responsibility), essential pipeline(s), road crossings, and other permanent facilities may be considered through the permitting process in these areas where the lessee can demonstrate on a site-specific basis that impacts will be minimal.	water birds fish

K-1 Lease Stipulation/Best Management Practice – Rivers **Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternatives, K-1 would be a best management practice. In Alternatives B-1 and B-2, portions of the Colville, Ikpikpuk, Kikiakrorak, Kogosukruk, and Titalik rivers have larger setbacks than in the other alternatives; see below for the details. Objective: Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin and campsites; the disruption of subsistence activities; and impacts to scenic and other resource values. Requirement/Standard: Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited in the streambed and adjacent to the rivers listed below at the distances identified. (Gravel mines may be located within the active floodplain consistent with Best Management Practice E-8).On a case-by case basis, and in consultation with federal, State, and North Slope Borough regulatory and resource agencies (as appropriate, based on agency legal authority and jurisdictional responsibility), essential pipeline and road crossings to the main channel will be permitted through setback areas. The above setbacks may not be practical within river deltas. In these situations, permanent facilities shall be designed to withstand a 200-year flood event. In the below list, if no upper limit for the setback is indicated, the setback extends to the head of the stream as identified in the National Hydrography Dataset. a. Colville River: a 1-mile setback (2-mile setback in Alternatives B-1 and B-2) from the boundary of NPR-A where the river determines the boundary along the Colville River as determined by cadastral survey to be the highest high watermark on the left (western or northern) bank and from both banks' ordinary high watermark where BLM-manages both sides of the river up through T5S, R30W, U.M. Above that point to its source at the juncture of Thunder and Storm creeks the setback will be 0.5 mile. Note: The planning area excludes conveyed Native lands along the lower reaches of the Colville River. Development of road crossings intended to support oil and gas activities shall be consolidated with other similar projects and uses to the maximum extent possible. Note: This provision does not apply to intercommunity or other permanent roads constructed with public funds for general transportation purposes, though the BLM would encourage minimal use of the setback area. This preserves the opportunity to plan, design, and construct public transportation systems to meet the economic, transportation, and public health and safety needs of the State of Alaska and/or communities within National Petroleum Reserve-Alaska.	water

Continued....K-1 Lease Stipulation/Best Management Practice – Riversb. Ikpikpuk River: a 0.5-mile setback from of the ordinary high watermark of the Ikpikpuk River extending from the mouth south to section 19, T7N, R11W, U.M. From section 19, T7N, R11W, U.M., to section 4, T3N, R12W, U.M., a 1-mile setback is required. Beginning at section. 4, T3N, R12W, U.M., a 0.5-mile setback from the centerline (1 mile total) will be required to the confluence of the Kigalik River and Maybe Creek. In Alternative B-1 and B-2, the setback would be 2 miles from the ordinary high watermark from the mouth of the river upstream through T7 N, R11W, U.M.; above that point the setback would be the same as described above in Alternative B-1 and 1 mile in Alternative B-2. c. Miguakiak River: a 0.5-mile setback from the bank's ordinary high watermark. d. Kikiakrorak and Kogosukruk Rivers: A 1-mile setback from the top of the bluff (or ordinary high watermark if there is no bluff) on the Kikiakrorak River downstream from T2N., R4W, U.M. and on the Kogosukruk River (including Branch of Kogosukruk River, Henry Creek, and two unnamed tributaries off the southern bank) downstream from T2N, R3W, U.M. In Alternatives B-1 and B-2, the setback would be 2 miles from the top of the bluff (or bank if there is no bluff) for the same waterbodies. The setback from these streams in Alternatives B-1 through D in the named townships and further upstream as applicable will be 0.5 mile from the top of the bluff or bank if there is no bluff. e. Fish Creek: a 3-mile setback from the bank's highest high watermark of the creek downstream from the eastern edge of section 31, T11N, R1E., U.M. and a 0.5-mile setback	water

from the bank's highest high watermark farther upstream.f. Judy Creek: a 0.5-mile setback from the banks' ordinary high watermark.g. Ublutuoch (TiJJmiaqsiugvik) River: a 0.5-mile setback from the ordinary high water mark.h. Alaktak River: a 0.5-mile (1 mile for Alternative B-2) setback from the ordinary high water mark. Etc.....	
K-2 Lease Stipulation/Best Management Practice – Deep Water Lakes **Note:** This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternatives, K-2 would be a best management practice. Objective: Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of deep water lakes; the loss of spawning, rearing or over wintering habitat for fish; the loss of cultural and paleontological resources; impacts to subsistence cabin and campsites; and the disruption of subsistence activities. Requirement/Standard: Generally, permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited on the lake or lakebed and within 0.25 mile of the ordinary high watermark of any deep lake as determined to be in lake zone III (i.e., depth greater than 13 feet [4 meters]; Mellor 1985). On a case-by-case basis in consultation with federal, State and North Slope Borough regulatory and resource agencies (as appropriate based on agency legal authority and jurisdictional responsibility), essential pipeline(s), road crossings, and other permanent facilities may be considered through the permitting process in these areas where the lessee can demonstrate on a site-specific basis that impacts will be minimal.	water

K-3a Stipulation – Teshekpuk Lake Shoreline **NOTE: this applies only to Alternative C.** Alternatives B-1 and B-2 have no comparable provision because no non-subsistence permanent infrastructure would be allowed within the Teshekpuk Lake shoreline area. Alternative D also has no comparable provision, but note that Teshekpuk Lake is a deep water lake to which Stipulation K-2 applies.Objective: Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of this large and regionally significant deep water lake; the loss of cultural and paleontological resources; impacts to subsistence cabins, campsites and associated activities; and to protect fish and wildlife habitat including important insect-relief areas.Requirement/Standard: Permanent oil and gas facilities, including gravel pads, roads, airstrips, and pipelines, are prohibited within 0.25 mile of the ordinary high watermark of Teshekpuk Lake. In addition, no permanent oil and gas facilities, except pipelines, will be allowed in portions of T1;4-15 N, R9W, and T15N, R8W, U.M. greater than 0.25 mile of the ordinary high watermark of Teshekpuk Lake as depicted on Map 2-3K. (No waiver, exception, or modification will be approved.)	water (NA)
K-3b Lease Stipulation/Best Management Practice – Kogru River, Dease Inlet, Admiralty Bay, Elson Lagoon, Peard Bay, Wainwright Inlet/Kuk River, and Kasegaluk Lagoon, and their associated Islands**Note**: This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-3b would be a best management practice. Alternatives B-1 and C, and, to a lesser extent, Alternative B-2, would generally prohibit non-subsistence permanent infrastructure in these waters. Objective: Protect fish and wildlife habitat (including, but not limited to, that for waterfowl and shorebirds, caribou insect-relief, marine mammals, and polar bear summer coastal habitat), preserve air and water quality, and minimize impacts to subsistence activities and historic travel routes on the major coastal waterbodies. Requirement/Standard (Exploration): Oil and gas exploration operations (e.g., drilling, seismic exploration, and testing) are not allowed on the major coastal waterbodies and coastal islands between May 15 and until November 1 or sea ice is within 10 miles of the coast of each season, whichever is later. Requests for approval of any activities must be submitted in advance and must be accompanied by evidence and documentation that demonstrates to the satisfaction of the authorized office and the US Fish and Wildlife Service that the actions or activities meet all of the following criteria: a. Exploration activities will not unreasonably conflict with subsistence uses or significantly impact seasonally concentrated fish and wildlife resources. b. There is adequate spill response capability to effectively respond during periods of broken ice and/or open water, or the availability of alternative methods to prevent well blowouts or pipeline leaks during periods when adequate response capability cannot be demonstrated. Such alternative methods may include improvements in blowout prevention technology, equipment and/or changes in operational procedures and "top-setting" of hydrocarbon-bearing zones. c. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic will be conducted to minimize additional impacts or further compounding of "direct spill" related impacts on area resources and subsistence uses. d. The location of exploration and related activities shall be sited so as to not pose a hazard to navigation by the public using high-use subsistence-related travel routes into and through the major coastal waterbodies, as identified by the North Slope Borough, recognizing that marine and nearshore travel routes change over time, subject to shifting environmental conditions.	water, birds, coastal lagoons , polar bears

Commented [14]: I think we may actually want to ask for no exploration ac ivities or permanent infrastructure in coastal water bodies that range from Arey Lagoon to Jago Lagoon due to myriad uses and resources in that area.

Commented [15]: While this is probably fine for summer/autumn polar bear ac ivities, coastal islands can be important areas for denning in winter.

Commented [16]: As I stated at the meeting, we may want to make the dates associated wi h this stipulation non-specific, and instead related it to environmental conditions given the an icipated changes in ice formation and snow deposition dates in the future.

K-3b Lease Stipulation/Best Management Practice – Nearshore marine and lagoon habitats of the Southern Beaufort Sea that are adjacent to the 1002 Area of the Arctic Refuge

Objective: Protect water quality, natural flow patterns, and temperature and salinity cycles in nearshore marine and lagoon habitats essential to the fish resources of the southern Beaufort Sea adjacent to the 1002 Area. The fish community in the nearshore area of the southern Beaufort Sea consists of about 12 marine and 9 anadromous species. The most common species harvested in subsistence fisheries are Dolly Varden and Arctic cisco, both anadromous fishes. Most of the anadromous species come from populations that overwinter in the Mackenzie River or farther east or the Sagavanirktok or Colville rivers and farther west. Only Dolly Varden and ninespine stickleback overwinter in the rivers flowing from the Arctic Refuge. Anadromous fishes feed during summer in nearshore habitats, often migrating hundreds of km east or west of their natal streams following the narrow, warm, brackish environment along shore where prey is concentrated and growth is maximized. This nearshore pathway is essential fish habitat.

Requirement/Standard (Development): With the exception of linear features such as pipelines, no permanent oil and gas facilities are permitted on or under the water within 1 mile seaward of the shoreline (as measured from mean high tide) of the major coastal lagoons or the natural barrier islands, or 1 mile inland from the mainland shoreline, unless they can meet all the following criteria:

a. Design and construction of facilities shall minimize impacts to subsistence uses, travel corridors, seasonally concentrated fish and wildlife resources.

b. Daily operational activities, including use of support vehicles, watercraft, and aircraft traffic, alone or in combination with other past, present, and reasonably foreseeable activities, shall be conducted to minimize impacts to subsistence uses, travel corridors, and seasonally concentrated fish and wildlife resources.

c. The location of oil and gas facilities, including artificial islands, platforms, associated pipelines, ice or other roads, bridges or causeways, shall be sited and constructed so as to not pose a hazard to navigation by the public using traditional high-use subsistence-related travel routes into and through the major coastal lagoons and bays as identified by the community of Kaktovik and the North Slope Borough.

d. Demonstrated year-round oil spill response capability, including the capability of adequate response during periods of broken ice or open water, or the availability of alternative methods to prevent well blowouts during periods when adequate response capability cannot be demonstrated. Such alternative methods may include seasonal drilling restrictions, improvements in blowout prevention technology, equipment and/or changes in operational procedures, and "top-setting" of hydrocarbon-bearing zones.

e. Reasonable efforts will be made to avoid or minimize impacts related to oil spill response activities, including vessel, aircraft, and pedestrian traffic that add to impacts or further compound "direct spill" related impacts on area resources and subsistence uses.

f. Before conducting open water activities, the lessee shall consult with the community of Kaktovik, the Alaska Eskimo Whaling Commission and the North Slope Borough to minimize impacts to the fall and spring subsistence whaling activities of the communities of the North Slope.

fish

Commented [17]: I'm limiting my contributions to fisheries related issues. I know the lagoons and nearshore areas are important habitats for other taxa as well, I just don't know the details well enough to expound on them.

K-8b Best Management Practice – Kasegaluk Lagoon Special Area **Note: This applies only to Alternatives B-1 and C**. There would be no comparable provision for Alternatives B-2 and D. This measure would be applied to relevant new leases. On lands unavailable for leasing in the respective alternative, K-8b would be a best management practice Objective: Protect the habitat of the fish, waterfowl, and terrestrial and marine wildlife resources of Kasegaluk Lagoon, and protect subsistence uses and public access to and through Kasegaluk Lagoon for current and future generations of North Slope residents. Requirement/Standard: No permanent oil and gas surface facilities are permitted in the Kasegaluk Lagoon and an area one mile inland from the lagoon.	water, birds
SUMMER VEHICLE TUNDRA ACCESS ***L-1 Best Management Practice*** Objective: Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain diversity and populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities. Requirement/Standard: On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Best management Practice C-2 a. Permission for such use would only be granted after an applicant has:a. Submitted studies satisfactory to the authorized officer of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation. b. Submitted surveys satisfactory to the authorized officer of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.	wildlife, vegetation, water, birds

FACILITY DESIGN AND CONSTRUCTION						
						FWS Category
Objective: *Maintain Wild classification for recommended rivers, so that their condition at the time of eligibility remains free of impoundments, with shorelines or watersheds still largely primitive and waters unpolluted.* **Requirement/Standard: No ~~leasing or~~ occupancy will be allowed within ½ mile on either side of the ordinary high outer banks upland of the the Hulahula River and its associated coastal lagoons, to insure no new temporary or permanent structures will be allowed within this recommended river corridor.** **Objective:** *Maintain Wild and Scenic Values for recommended rivers, which includes free flowing condition; water quality at time the river was found eligible; and Outstandingly Remarkable Values (ORV) for each river segment.* **Requirement/Standard:** ***To insure free-flowing condition,* proposed activities with the potential to impact bed and banks of the recommended rivers, and/or with the potential to affect flow within or downstream of recommended rivers, will be assessed prior to commencement of activity. No activities impacting bed and banks and/or affecting flow within or downstream of recommended rivers will occur, to insure consistency with the protective management mandate for maintaining free-flowing condition. This assessment requirement and prohibition applies to activities proposed for the Canning River below the Marsh Fork of the Canning, the Hulahula River and associated coastal lagoons, and the coastal lagoons between the Kongakut River delta and Kaktovik Lagoon.** **Requirement/Standard:** ***To insure water quality at the time recommended rivers were found eligible,* no occupancy will be allowed within ½ mile on either side of the ordinary high outer banks upland of the Hulahula River and associated coastal lagoons; and no activities will occur with the potential to affect water quality of the Canning River downstream of the Marsh Fork-Canning River and the coastal lagoons between the Kongakut River delta and Kaktovik.** **Requirement/Standard:** ***To meet protective management responsibilities for ORVs of recommended rivers,* no occupancy will be allowed within a 5 mile buffer on either side of the ordinary high outer banks upland of the the Hulahula River and associated coastal lagoons; and use of best practices for soundscape and visual resource impact mitigation from new infrastructure located outside of, but audible or visible from within, the buffer will be practiced (see Recreation Stips and BMPS Table). Additionally, no occupancy will be allowed within a ½ mile buffer of the Canning River downstream of the Marsh Fork-Canning River and a ½ mile buffer of the Kongakut River downstream of the coastal lagoons between the Kongakut River delta and Kaktovik Lagoon; and use of best practices for soundscape and visual resource impact mitigation from new infrastructure located outside of, but audible or visible from within, the buffer will be practiced (see Recreation Stips and BMPS Table).** **At the time of application for construction of temporary or permanent facilities, or activities located outside of but audible or visible from within said buffers, the lessee/permittee shall, after consultation with the authorized officer, submit a plan to best minimize impacts to ORVs as the values are described in the *Detailed Analyses of Each Outstandingly Remarkable Value***						WSRs. Cross reference: recreation, wildlife, subsistence (cultural ORV), water and fish

Commented [1]: This is different than the 1/2 mile listed in the 1st Requirement/standard for he hulahula

Commented [2]: Intentional. The need for 1/2 mile buffer for 1st requirement is tied to first requirement; need for 5 mile buffer is tied to the ORVs

found within Appendix B of the Wild and Scenic River Review. For example, in protecting the scenic ORV, when developing best practices for visual resources management, diversity of view, special features, and seasonal variations should be considered. A photo simulation of the proposed facilities may be a necessary element of the plan. Objective: *To meet protective management responsibilities for cultural ORVs of recommended rivers by insuring areas where activities are proposed are evaluated for preservation of archaeological resources.* Requirement/Standard:						
USE OF AIRCRAFT in RECOMMENDED WSR CORRIDOR						

Commented [3]: I am unqualified to add a Requirement/Standard here, but suppose Hollis could insert ARPA language here?

Objective: *To meet protective management responsibilities for cultural ORVs of recommended rivers by minimizing the effects of low-flying aircraft on wildlife, subsistence activities, and local communities.* Requirement/Standard: a. Aircraft shall maintain an altitude of at least X,XXX feet above ground level when within 0.5 mile of Kaktovik Lagoon when whaling activities are occurring (August-October), within 0.5 mile of Canning and Hulahula buffers during prime subsistence use periods (insert dates here; and fall caribou hunting), unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from the BLM necessary to plan flight routes when routes may go near primary subsistence sites. b. Aircraft shall maintain an altitude of at least XXXX feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the authorized officer. The BLM will consult directly with the Alaska Department of Fish and Game in annually defining caribou winter ranges. c. Land user shall submit an aircraft use plan as part of an oil and gas exploration or development proposal. The plan shall address strategies to minimize impacts to the cultural ORV. Such considerations include minimizing impacts to areas of notable occupation, of subsistence importance, and of value to a number of cultures, among other components. Impacts to be considered include but are not limited to the number of flights, type of aircraft, and flight altitudes and routes, and shall also include a plan to monitor flights. Proposed aircraft use plans should be reviewed by appropriate federal, State, and borough agencies. Consultations with these same agencies will be required if unacceptable disturbance is identified by subsistence users. Adjustments, including possible suspension of all flights, may be required by the authorized officer if resulting disturbance is determined to be unacceptable. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered to allow larger aircraft to be employed, resulting in fewer flights to the facility. d. Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum.	WSRs Cross refe subsisten (cultural wildlife, recreation,

Commented [4]: In Recreation's stips table, I include an aircraft objec ive specific to rec: "Minimize he effects of low-flying aircraft on recrea ional ac ivities and the wildlife visitors come to watch, photograph, or harvest." with similar language.

Commented [5]: Can Hollis look at this section?

Commented [6]: Maybe Steve can make this consistent with other specifications for Caribou?

Commented [7]: Once those determinations are complete, should confirm not in conflict with recreation's aircraft stipulation

Additional useful info:
Hulahula: Recommended so must use existing management tools to protect W&S River Values (includes free flow, water quality, and ORVs). Hulahula found to have recreational and cultural ORVs at the time of Eligibility. See WSR Review Appendix I, section 5.5.2, Page I-74; and Appendix I, Appendix B, Sections B-1 and B-2).

Canning: Found Eligible because of ORVs for fish, wildlife, cultural, and recreation but not found suitable in WSR Review. When combined with the MF-Canning (since most floaters put in above the confluence and continue down to the Lower Canning) this drainage rivals Hulahula as second most visited Coastal Plain river in Refuge. No specific protections required by law for Canning below confluence of MF-Canning, but activities downstream that could have an effect on the W&S River Values (includes free flow, water quality, and ORVs) for recommended section above are required to be mitigated to protect condition at time of eligibility.

Kongakut: Most visited river in Refuge. Activities below recommended Kongakut River (in this case coastal lagoons between Icy Reef and Kaktovik Lagoon) my affect the "associated superlative opportunities" tied to the Kongakut's recreational, scenic and geologic ORVs such as "offering the highest likelihood of viewing the Porcupine caribou herd and the earlier weeks of the Dall's sheep hunting season...[and} allow[ing] a boater the unique opportunity to journey along Icy Reef" (CCP Appendix I, Section 5.7.2, page I-89; and CCP Appendix I.B-1 and -2, pages I-B1 to B3) and into Kaktovik. No specific protections required by law for coastal lagoons below mouth of Kongakut, but activities downstream that could have an affect on this recommended river's ORVs are required to be mitigated to protect River Values (includes free flow, water quality, and ORVs).

K-W Lease Stipulation – Wilderness Boundary Objective: Protect wilderness values within the Mollie Beattie Wilderness Area Requirement/Standard: Surface occupancy, including exploratory and production well drill pads, structures and facilities, gravel and ice roads would not be allowed within 3 miles of the southern and eastern boundaries of the 1002 area where they are adjacent to designated Wilderness. All lessees/permittees involved in the immediate area must coordinate use of these sites with all other prospective users. To the extent practicable, aircraft operations will be planned to minimize flights below 2,000 feet above ground level above the buffer.	Wilderness

Commented [1]: Roger's recommended stipulation to protect designated Wilderness adjacent to the coastal plain.

WASTE PREVENTION, HANDLING, DISPOSAL, SPILLS, AND PUBLIC SAFETY						
Alternative B-1	**Alternative B-2 Preferred Alternative**			**Alternative C**	**Alternative D**	FWS Category
A-2 Best Management Practice Objective: Minimize impacts on the environment from non-hazardous and hazardous waste generation. Encourage continuous environmental improvement Protect the health and safety of oil and gas field workers, local communities, refuge subsistence users, Refuge recreational users, and the general public. Avoid human-caused changes in predator populations. Avoid attracting predators, particularly bears, to human-use areas. Requirement/Standard: Lessees/permittees shall prepare and implement a comprehensive waste management plan for all phases of exploration and development, and production, including seismic activities. The plan shall include methods and procedures to use bear resistant containers for all waste materials and classes. The plan shall be submitted to the authorized officer for approval, in consultation with federal, State, and North Slope Borough regulatory and resource agencies, as appropriate (based on agency legal authority and jurisdictional responsibility), as part of a plan of operations or other similar permit application. Management decisions affecting waste generation shall be addressed in the following order of priority: (1) prevention and reduction, (2) recycling, (3) treatment, and (4) disposal. The plan shall consider and take into account the following requirements: a. Methods to avoid attracting wildlife to food and garbage. The plan shall identify precautions that are to be taken to avoid attracting wildlife to food and garbage, specifically, methods and procedures for handling and disposal of waste. The use of bear resistant containers for all waste shall be specified. b. Disposal of putrescible waste. Requirements prohibit the burial of garbage. Lessees and permitted users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. The use of bear resistant containers for all waste shall be specified. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the authorized officer. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility in accordance with EPA and Alaska Department of Environmental Conservation regulations and procedures. The burial of human waste is prohibited except as authorized by the authorized officer. c. Disposal of pumpable waste products. Except as specifically provided, the BLM requires that all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, Alaska Department of Environmental Conservation, and the Alaska Oil and Gas Conservation Commission regulations and procedures. On-pad temporary muds and cuttings storage, as approved by Alaska Department of Environmental Conservation, will be allowed as necessary to facilitate annular injection and/or backhaul operations. d. Disposal of wastewater and domestic wastewater. The BLM prohibits wastewater discharges or disposal of domestic wastewater into bodies of fresh, estuarine, and marine water, including wetlands, unless authorized by a National Pollutant Discharge Elimination System or State permit.						contaminants, wildlife

Commented [1]: My comments are highlighted in yellow.

A-8 Best Management Practice Objective: Minimize conflicts resulting from interaction between humans and bears during oil and gas activities. Requirement/Standard: Oil and gas lessees, their contractors and subcontractors, and all other personnel associated with authorized oil and gas activities will, as a part of preparation of lease operation planning, prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These bear-interaction plans shall be developed in consultation with and approved by the U.S Fish & Wildlife Service and the Alaska Department of Fish and Game. The plans shall include specific measures to Identify and establish: a. Methods and procedures to minimize attraction of bears to the work sites, e.g., bear resistant containers for all waste categories, waste handling, waste removal and disposal. b. The organization and layout of buildings and work sites to minimize human/bear interactions. c. Communication methods and procedures to warn personnel of bears near or on work sites. d. Identify and establish personnel, methods, procedures, and training, if authorized, to discourage bears from approaching the work site using passive and active, non-injurious, less-lethal methods. e. Identify and establish contingencies in the event bears do not leave the work site or cannot be discouraged by authorized personnel. f. Identify and establish methods and procedures for the proper storage and disposal of materials that may be attractive, or toxic, or both to bears, e.g., bear resistant waste containers. g. A systematic record of bears on the work site and in the immediate area. h. Methods, procedures, and training to identify and avoid known or observed polar bear dens by at least 1-mile, and grizzly bear dens by at least 0.5-mile, unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service, or the Alaska Department of Fish and Game, or both as appropriate. i. Methods and procedures to minimize disturbance to polar bear dens from oil and gas activities.	wildlife, polar bears
WINTER OVERLAND MOVES AND SEISMIC WORK	
The following required operating procedures/best management practices apply to overland and overice moves, seismic work, and any similar cross-country use of vehicles and heavy equipment on non-roaded surfaces during the winter season.	
C-1 Best Management Practice Objective: Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations. Requirement/Standard: a. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 0.5 mile of known or observed grizzly bear dens unless alternative protective measures are approved by the authorized officer in consultation with the Alaska Department of Fish and Game. b. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed polar bear dens unless alternative protective measures are approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service. c. All oil and gas activity, including cross-country use of vehicles, equipment, and seismic survey activity, is prohibited within 1-mile of known or observed seal birthing lairs unless alternative protective measures are approved by the authorized officer in consultation with the National Oceanographic and Atmospheric Administration. d. Between October 30 and April 15 of any year, operators working within polar bear denning, and seal birthing habitat, shall conduct a survey for polar bear dens and seal birthing lairs in consultation with the U.S. Fish and Wildlife Service, or the National Oceanographic and Atmospheric Administration, or both as appropriate, throughout the planned area of activities and before initiating activities.	polar bears, wildlife

FACILITY DESIGN AND CONSTRUCTION						
E-1 Best Management Practice Objective: Protect subsistence use and access to subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish and wildlife resources. Requirement/Standard: a. All roads must be designed, constructed, maintained, and operated to create minimal environmental impacts and to protect subsistence use and access to subsistence hunting and fishing areas. The authorized officer will consult with appropriate federal, State, and North Slope Borough regulatory and resources agencies prior to approving construction of roads. b. Subject to approval by the authorized officer, the construction, operation and maintenance of oil and gas field roads is the responsibility of the lessee unless the construction, operation, and maintenance of roads are assumed by the appropriate governing entity. c. All infrastructure, including pads, facilities, and pipelines, among others, must be designed, constructed, maintained, and operated to create minimal impacts and disruption to the movement of wildlife across the landscape, and the availability and use of habitat by wildlife.						subsistence, wildlife
E-9 Best Management Practice Objective: Avoidance of human-caused increases in populations of predators of ground-nesting birds. Requirement/Standard: a. Lessee shall utilize best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee shall provide the authorized officer with an annual report on the use of oil and gas facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites. b. Feeding of wildlife is prohibited and will be subject to non-compliance regulations.						wildlife, birds
E-12 Best Management Practice Objective: Use ecological mapping as a tool to assess wildlife habitat before development of permanent facilities, to conserve important habitat types during development. Requirement/Standard: An ecological land classification map of the development area shall be developed before approval of facility construction. The map will integrate geomorphology, surface form, and vegetation at a scale, level of resolution, and level of positional accuracy adequate for detailed analysis of development alternatives. The map shall be prepared in time to plan one season of ground-based wildlife surveys, if deemed necessary by the authorized officer, before approval of the exact facility location and facility construction.						wildlife
E-19 Best Management Practice Objective: Provide information to be used in monitoring and assessing wildlife movements during and after construction. Requirement/Standard: A representation, in the form of ArcGIS-compatible shape-files, of all new infrastructure construction shall be provided to the authorized officer. During the planning and permitting phase, shape-files representing proposed locations shall be provided. Within 6 months of construction completion, shape-files (within GPS accuracy) of all new infrastructure shall be provided. Infrastructure includes all gravel roads and pads, facilities built on pads, pipelines and independently constructed powerlines (as opposed to those incorporated in pipeline design). Gravel pads shall be included as polygon feature. Roads, pipelines, and powerlines may be represented as line features but must include ancillary data to denote width, number pipes, etc. Poles for power lines may be represented as point features. Ancillary data shall include construction beginning and ending dates.						caribou, wildlife
USE OF AIRCRAFT FOR PERMITTED ACTIVITIES						

F-1 Best Management Practice Objective: Minimize the effects of low-flying aircraft on wildlife, subsistence activities, and local communities. Requirement/Standard: The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines (**Note:** This best management practice is not intended to restrict flights necessary to survey wildlife to gain information necessary to meet the stated objectives of the stipulations and best management practices. However, flights necessary to gain this information will be restricted to the minimum necessary to collect such data.): a. Aircraft shall maintain an altitude of at least 1,500 feet above ground level when within 0.5 mile of cliffs identified as raptor nesting sites from April 15 through August 15 and within 0.5 mile of known gyrfalcon nest sites from March 15 to August 15, unless doing so would endanger human life or violate safe flying practices. Permittees shall obtain information from the BLM necessary to plan flight routes when routes may go near falcon nests. b. Aircraft shall maintain an altitude of at least 1,000 feet above ground level (except for takeoffs and landings) over caribou winter ranges from December 1 through May 1, unless doing so would endanger human life or violate safe flying practices. Caribou wintering areas will be defined annually by the authorized officer. The BLM will consult directly with the Alaska Department of Fish and Game in annually defining caribou winter ranges. c. Land user shall submit an aircraft use plan as part of an oil and gas exploration or development proposal. The plan shall address strategies to minimize impacts to subsistence hunting and associated activities, including but not limited to the number of flights, type of aircraft, and flight altitudes and routes, and shall also include a plan to monitor flights. Proposed aircraft use plans should be reviewed by appropriate federal, State, and borough agencies. Consultations with these same agencies will be required if unacceptable disturbance is identified by subsistence users. Adjustments, including possible suspension of all flights, may be required by the authorized officer if resulting disturbance is determined to be unacceptable. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered to allow larger aircraft to be employed, resulting in fewer flights to the facility. d. Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum.	subsistence, wildlife, Wilderness, recreation

Continued....F-1 Best Management Practicee. e. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet above ground level (except for takeoffs and landings) from May 20 through July 20, unless doing so would endanger human life or violate safe flying practices. f. (Alternative B-2 only) Hazing of wildlife by aircraft is prohibited. Pursuit of running wildlife is hazing. If wildlife begins to run as an aircraft approaches, the aircraft is too close and must break away. h. (Alternative B-2 only) Fixed wing aircraft used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 2,000 feet and a 0.5-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices. Helicopters used as part of a BLM- authorized activity along the coast shall maintain minimum altitude of 3,000 feet and a 1-mile buffer from walrus haulouts, unless doing so would endanger human life or violate safe flying practices i. (Alternative B-2 only) Aircraft used as part of a BLM-authorized activity along the coast and shore fast ice zone shall maintain minimum altitude of 3,000 feet and a buffer of 1 mile from aggregations of seals, unless doing so would endanger human life or violate safe flying practices. j. Aircraft shall maintain an altitude of at least 1,500 feet above ground level when within 0.5 mile of polar bears observed on land, ice, or in the water, unless doing so would endanger human life or violate safe flying practices. At all times, aircraft shall maintain the maximum distance and altitude possible from concentrations of polar bears, particularly at the whale "bone pile" on Barter Island, and should take precautions to avoid flying lower than 1,500 feet above ground level directly over or within 0.5 mile of these areas, unless doing so would endanger human life or violate safe flying practices.	subsistence, wildlife, Wilderness, recreation
I-1 Best Management Practice Objective: Minimize cultural and resource conflicts. Requirement/Standard: All personnel involved in oil and gas and related activities shall be provided information concerning applicable stipulations, best management practices, standards, and specific types of environmental, social, traditional, and cultural concerns that relate to the region. The lessee/permittee shall ensure that all personnel involved in permitted activities shall attend an orientation program at least once a year. The proposed orientation program shall be submitted to the authorized officer for review and approval and should: a. provide sufficient detail to notify personnel of applicable stipulations and best management practices as well as inform individuals working on the project of specific types of environmental, social, traditional and cultural concerns that relate to the region. b. Address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals, and provide guidance on how to avoid disturbance. c. Include guidance on the preparation, production, and distribution of information cards on endangered and/or threatened species. d. Be designed to increase sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which personnel will be operating. e. Include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation. f. Include information for aircraft personnel concerning subsistence activities and areas/seasons that are particularly sensitive to disturbance by low-flying aircraft. Of special concern is aircraft use near traditional subsistence cabins and campsites, flights during spring goose hunting and fall caribou and moose hunting seasons, and flights near North Slope communities. g. Provide that individual training is transferable from one facility to another except for elements of the training specific to a particular site. h. Include on-site records of all personnel who attend the program for so long as the site is active, though not to exceed the 5 most recent years of operations. This record shall include the name and dates(s) of attendance of each attendee. i. Include a module discussing bear interaction plans to minimize conflicts between bears and humans. j. Provide a copy of 43 CFR 3163 regarding Non-Compliance Assessment and Penalties to on-site personnel.	subsistence, cultural, wildlife

Commented [2]: This is not relevant for the Arctic Refuge coastal plain.

k. Include training designed to ensure strict compliance with local and corporate drug and alcohol policies. This training should be offered to the North Slope Borough Health Department for review and comment. l. Include training developed to train employees on how to prevent transmission of communicable diseases, including sexually transmitted diseases, to the local communities. This training should be offered to the North Slope Borough Health Department for review and comment.						
ENDANGERED SPECIES ACT—SECTION 7 CONSULTATION PROCESS						
J. The lease areas may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status. The BLM may require modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activities that will contribute to the need to list such a species or their habitat. The BLM may require modifications to or disapprove a proposed activity 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 as amended, 16 USC § 1531 et seq., including completion of any required procedure for conference or consultation.						Wildlife, Vegetation, birds
SUMMER VEHICLE TUNDRA ACCESS						
L-1 Best Management Practice Objective: Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities. Requirement/Standard: On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in Best management Practice C-2 a. Permission for such use would only be granted after an applicant has:a. Submitted studies satisfactory to the authorized officer of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. These studies should reflect use of such vehicles under conditions similar to those of the route proposed for use and should demonstrate that the proposed use would have no more than minimal impacts to soils and vegetation. b. Submitted surveys satisfactory to the authorized officer of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the authorized officer. c. Designed and/or modified the use proposal to minimize impacts to the authorized officer's satisfaction. Design steps to achieve the objectives and based upon the studies and surveys may include, but not be limited to, timing restrictions (generally it is considered inadvisable to conduct tundra travel prior to August 1 to protect ground-nesting birds), shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the authorized officer, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan required by 40 CFR 112 (Oil Pollution Act) and Required Operating Procedure A-4.						wildlife, vegetation, water, birds
GENERAL WILDLIFE AND HABITAT PROTECTION						
M-1 Best Management Practice Objective: Ensure that the Refuge meets the ANILCA mandate "to conserve fish and wildlife populations and habitats in their natural diversity" Requirement/Standard: Activities associated with exploration, production, and transportation of oil and gas resources will be conducted in such a way as to not substantially alter the natural abundance and diversity of wildlife species. Development proponents will work with managing agencies to establish appropriate assessment and monitoring protocols to ensure that populations are maintained. Where data on species occurrence and abundance are lacking, appropriate surveys will be conducted prior to development to determine baseline population levels.						

M-1 Best Management Practice **NOTE**: **This best management practice is only applicable to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: Minimize disturbance and hindrance of wildlife, or alteration of wildlife movements through the coastal plain of the Arctic National Wildlife Refuge. Requirement/Standard: Chasing wildlife with ground vehicles, or aircraft, or both is prohibited. Particular attention will be given to avoid disturbing caribou and polar bears.	wildlife
M-4 Best Management Practice **NOTE**: **This best management practice is applicable only to Alternative B-2**. There would be no comparable provision for any of the other alternatives. Objective: Minimize loss of individuals of, and habitat for, mammalian species that are rare or endemic to the arctic. Requirement/Standard: If a development is proposed in an area that provides potential habitat for the **Alaska tiny shrew**, the development proponent would conduct surveys at appropriate times of the year and in appropriate habitats in an effort to detect the presence of the shrew. The results of these surveys will be submitted to BLM with the application for development.	wildlife

From:	Twitchell, Hollis
To:	Berendzen, Steve
Cc:	Joanna Fox; Joshua Rose; Ted Swem; Christopher Latty; Randy Brown; Jennifer Reed; Stephen Arthur; Kevin Doherty; Roger Kaye
Subject:	Re: Needed Monday afternoon: short sections for preface to alternatives document
Date:	Friday, June 22, 2018 7:57:31 PM
Attachments:	Executive Summary for FWS Recommendations for Alternatives Development (1).docx

Subsistence paragraphs added to the end of the original draft below.

On Fri, Jun 22, 2018 at 3:48 PM, Berendzen, Steve <steve_berendzen@fws.gov> wrote:

> Greetings,
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> Attached is a draft introduction to a 2 page (maximum) preface to our recommendations. Each resource specialist should provide one paragraph. Your paragraph should relate directly to the first sentence of the draft; the purpose is to generally convey why we placed the lines on the map as we did. Paragraphs should be no more than 100 words, preferably less, except for Steve who will do both caribou & other mammals. No references cited; this is more like an abstract. Roger will put it together and transition paragraphs--contact him or me if you have questions
>
> Steve Berendzen
> Refuge Manager, Arctic National Wildlife Refuge
> 907-456-0253

On Thu, Jun 21, 2018 at 6:07 PM, Kaye, Roger <roger_kaye@fws.gov> wrote:

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> Josh, could you please draft the paragraph b5 -dp [redacted]
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> Kevin, as discussed, could you b5 -dp [redacted]
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> **Roger Kaye**
> Arctic National Wildlife Refuge
> 101 12th Ave, Room 236
> Fairbanks, AK 99701
> Anchorage, AK 99503
> #: 907-456-0405 | e: Roger_Kaye@fws.gov

--
Hollis Twitchell
Assistant Manager
Arctic Refuge
907 456-0512 w
907 378-5732 c

Draft Preface for

FWS Recommendations for Lease Sale Alternatives

b5 -dp

[redacted]

[redacted]

[redacted]

Traditional Use and Subsistence:

b5 -dp

[redacted]

b5 -dp

From:	Arthur, Stephen
To:	Twitchell, Hollis
Cc:	Berendzen, Steve; Joanna Fox; Joshua Rose; Ted Swem; Christopher Latty; Randy Brown; Jennifer Reed; Kevin Doherty; Roger Kaye
Subject:	Re: Needed Monday afternoon: short sections for preface to alternatives document
Date:	Sunday, June 24, 2018 10:16:22 PM
Attachments:	Executive Summary for FWS Recommendations for Alternatives Development.docx

I have added the terrestrial mammals paragraph to Hollis' version.

Stephen M. Arthur, Ph.D.
Supervisory Wildlife Biologist
Arctic National Wildlife Refuge
101 12th Ave., Room 236
Fairbanks, AK 99701
(907)455-1830

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Hollis Twitchell
Assistant Manager
Arctic Refuge
907 456-0512 w
907 378-5732 c

Draft Preface for

FWS Recommendations for Lease Sale Alternatives

b5 -dp

[redacted]

[redacted]

[redacted]

Terrestrial wildlife: b5 -dp

[redacted]

b5 -dp [redacted]

Traditional Use and Subsistence: b5 -dp [redacted]

From:	Brown, Randy
To:	Arthur, Stephen
Cc:	Twitchell, Hollis; Berendzen, Steve; Joanna Fox; Joshua Rose; Ted Swem; Christopher Latty; Jennifer Reed; Kevin Doherty; Roger Kaye
Subject:	Re: Needed Monday afternoon: short sections for preface to alternatives document
Date:	Monday, June 25, 2018 11:19:47 AM
Attachments:	Executive Summary for FWS Recommendations for Alternatives Development (wRJB).docx

Following Steve's lead, this file adds a section on perennial springs and fish to the document. Please edit, reorganize, and adjust as necessary.
Randy

On Sun, Jun 24, 2018 at 8:15 PM, Arthur, Stephen <stephen_arthur@fws.gov> wrote:

> I have added the terrestrial mammals paragraph to Hollis' version.
>
> Stephen M. Arthur, Ph.D.
> *Supervisory Wildlife Biologist*
> *Arctic National Wildlife Refuge*
> *101 12th Ave., Room 236*
> *Fairbanks, AK 99701*
> *(907)455-1830*
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Roger Kaye
Arctic National Wildlife Refuge
101 12th Ave., Room 236
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#: 907-456-0405 | e: Roger_Kaye@fws.gov

--
Hollis Twitchell
Assistant Manager
Arctic Refuge
907 456-0512 w
907 378-5732 c

--
Randy J. Brown
Fishery Biologist
U.S. Fish and Wildlife Service
101 12th Ave., Room 110
Fairbanks, Alaska 99701

Phone: (907) 456-0295
E-mail: <randy_j_brown@fws.gov>

Draft Preface for

FWS Recommendations for Lease Sale Alternatives

b5 -dp

[redacted]

[redacted]

[redacted]

Terrestrial wildlife: b5 -dp [redacted]

b5 -dp [redacted]

Traditional Use and Subsistence: b5 -dp [redacted]

Perennial Springs and Fish: b5 -dp [redacted]

From:	Arthur, Stephen
To:	Roger Kaye; Berendzen, Steve
Cc:	Twitchell, Hollis; Joanna Fox; Joshua Rose; Ted Swem; Christopher Latty; Jennifer Reed; Kevin Doherty; Brown, Randy
Subject:	Re: Needed Monday afternoon: short sections for preface to alternatives document
Date:	Monday, June 25, 2018 1:22:33 PM
Attachments:	Executive Summary for FWS Recommendations for Alternatives Development_HT_SA_RB_CL.docx

I have attached a paragraph on birds to add to the subsistence, mammals, and fish sections.

Stephen M. Arthur, Ph.D.
Supervisory Wildlife Biologist
Arctic National Wildlife Refuge
101 12th Ave., Room 236
Fairbanks, AK 99701
(907)455-1830

On Mon, Jun 25, 2018 at 9:19 AM, Brown, Randy <randy_j_brown@fws.gov> wrote:

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Josh, could you please draft b5 -dp [redacted]

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Others, please provide a summary paragraph, short, by Monday afternoon

Roger Kaye
Arctic National Wildlife Refuge
101 12th Ave., Room 236
Fairbanks, AK 99701
Anchorage, AK 99503
#: 907-456-0405 | e: Roger_Kaye@fws.gov

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Hollis Twitchell
Assistant Manager
Arctic Refuge
907 456-0512 w
907 378-5732 c

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Randy J. Brown
Fishery Biologist
U.S. Fish and Wildlife Service
101 12th Ave., Room 110
Fairbanks, Alaska 99701

Phone: (907) 456-0295
E-mail: <randy_j_brown@fws.gov>

Draft Preface for

FWS Recommendations for Lease Sale Alternatives

b5 -dp

[redacted]

[redacted]

[redacted]

Terrestrial wildlife: b5 -dp [redacted]

b5 -dp

[redacted]

Traditional Use and Subsistence: b5 -dp

[redacted]

Perennial Springs and Fish: b5 -dp

[redacted]

Birds: b5 -dp

[redacted]


b5 -dp

From:	Doherty, Kevin
To:	Brown, Randy
Cc:	Arthur, Stephen; Twitchell, Hollis; Berendzen, Steve; Joanna Fox; Joshua Rose; Ted Swem; Christopher Latty; Jennifer Reed; Roger Kaye
Subject:	Re: Needed Monday afternoon: short sections for preface to alternatives document
Date:	Tuesday, June 26, 2018 1:18:19 PM
Attachments:	Executive Summary FWS Recs Alternatives Development 26June2018.docx

Hi all,

Please see the attached first attempt to meld everybody's sections. If we missed the mark, lets talk about it at noon and get a game plan to fix it. I really tried my best to capture your main points and synthesize and distill the original writing as all sections were long. Hopefully it does not fall to short, but we still can edit this afternoon.

Cheers
Kevin

On Tue, Jun 26, 2018 at 10:41 AM, Doherty, Kevin <kevin_doherty@fws.gov> wrote:

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Steve Berendzen
Refuge Manager, Arctic National Wildlife Refuge
907-456-0253

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Executive Summary USFWS Pre-meeting for
BLM Lease Sale Alternative Workshop

b5 -dp

[redacted]

Below are short summaries by priority areas.

Polar Bears: Coming Shortly from RO

Caribou: b5 -dp

[redacted]

Commented b5 -dp [redacted]

Traditional Use and Subsistence: b5 -dp

[redacted]

Perennial Springs and Fish: b5 -dp [redacted].

Coastal Lagoons: b5 -dp [redacted]

b5 -dp [redacted]

[redacted]

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Other Considerations: b5 -dp [redacted]

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From:	Wendy Loya
To:	Paul Leonard; John Trawicki; Randy Brown; Jennifer Reed; Joanna Fox; Hollis Twitchell; Drew Crane; Lynnda Kahn; Angela Matz; Christopher Latty; Patrick O"Dell; Carl Johnson; John Martin; Stephen Arthur; Steve Berendzen; Joshua Ream; Eric Taylor; Richard Lanctot; Catherine Collins; Roger Kaye; Edward Decleva; Tim Allen; Ryan Wilson; Joshua Rose; Christopher Putnam; Ted Swem; Charles Hamilton; Gilbert Castellanos; Peter Butteri
Cc:	Doug Damberg; Mitch Ellis; Socheata Lor; Mary Colligan; Karen Murphy; Sara Boario; Todd Hopkins
Subject:	FWS expertise sharing for Coastal Plain Leasing EIS
Date:	Tuesday, June 26, 2018 2:23:29 PM

Hi 1002 team,

As we heard on the Leasing EIS kick-off call, BLM and its contractors are full steam ahead on the Draft EIS. Many of you have already been contacted for information that will help shape the Draft Affected Environment, and a few questions have arisen with regards to how Service staff can and should respond. It is our intent for all staff with expertise to share facts and information within the area of their expertise freely with their counterparts at BLM and EMPSi. Ideally we can refer to published information, such as reports, papers, the CCP and other documents that will provide peer- or management- reviewed information. We have provided BLM and the contractor with the Draft Affected Environment chapter prepared for the Seismic EA as background material, but it does not cover everything. It is not our role to write significant portions of the Leasing EIS Affected Environment, DOI chose a contractor to do that, but to provide information that will help the writers understand and accurately describe the Arctic Refuge Coastal Plain.

If you are unsure about how to respond to any request, or a request is asking for interpretation of information in a management context, please send the request through your POC (Arctic Refuge: Steve B/Joanna, FES: Drew Crane, NWRS: John Trawicki, Mig Birds: Eric Taylor) or directly to me and we will help.

Also, thank you all, again, for your great input and hard work last week and into this week on the Alternatives, Stips and BMPs ☺

Sincerely ,
Wendy

Dr. Wendy M. Loya,
Arctic Program Coordinator
Office of Science Applications, US Fish and Wildlife Service
Anchorage, Alaska
907.786.3532 (office)
907.277.2942 (mobile)

From:	Arthur, Stephen
To:	Doherty, Kevin; Joanna Fox
Cc:	Brown, Randy; Twitchell, Hollis; Berendzen, Steve; Joshua Rose; Ted Swem; Christopher Latty; Jennifer Reed; Roger Kaye
Subject:	Re: Needed Monday afternoon: short sections for preface to alternatives document
Date:	Tuesday, June 26, 2018 5:09:22 PM
Attachments:	Executive Summary FWS Recs Alternatives Development 26June2018_SA.docx

My latest edits are in Red text. Comments and suggestions are very welcome!

Steve

Stephen M. Arthur, Ph.D.
Supervisory Wildlife Biologist
Arctic National Wildlife Refuge
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(907)455-1830

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Executive Summary USFWS Pre-meeting for BLM Lease Sale Alternative Workshop

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Birds: b5 -dp [redacted]

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b5-dp

[redacted]

Wild and Scenic Rivers and other Recreation: b5 -dp

[redacted]

Other Considerations: b5 -dp

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