

CHAPTER 4: MAJOR ISSUES RELATED TO OIL AND GAS ACTIVITIES

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4.1 Introduction

This chapter provides details about issues related to the seven subject areas covered by the Technical Report:

1. Communication and coordination,
2. Tundra travel,
3. Roads,
4. Pipelines,
5. Gravel islands,
6. Air traffic, and
7. Dismantlement, removal and restoration (DR&R).

The purpose of this chapter is to provide an overview of issues, summarize how agencies mitigate impacts and identify areas that need more attention. Recommendations for issues that need additional mitigation are included in Chapter 5. While the discussion of mitigation does not involve a comprehensive review of agency laws, it does reflect federal, state and local mitigation measures in recent documents. Specifically, the following documents were reviewed to identify measures that address each the seven topic areas covered by the Technical Report.

- **NPR-A Record of Decision (ROD):** The February 2013 ROD for the 2012 EIS/Integrated Activity Plan includes stipulations that will be carried on oil and gas leases as well as enforceable best management practices (BMPs) that will be included on land use permits.
- **Best Interest Findings:** The best interest findings for both the North Slope Areawide and Beaufort Sea oil and gas lease sales include enforceable mitigation measures and non-enforceable notices to lessees.
- **Title 19 Zoning Code:** The NSB Title 19 zoning code includes criteria for approval and enforceable policies that are applied to oil and projects.
- **NSB Permit Stipulations:** The Planning Department maintains a list of standard stipulations that are placed on land use permits.
- **NSB Coastal Management Plan Enforceable Policies:** The 2007 Draft of the NSB Coastal Management Plan included draft enforceable policies. While these draft policies did not receive final state and federal approval, the NSB spent a considerable effort developing them, and the draft plan was approved by the NSB Assembly.

Each section ends with a conclusion that summarizes how issues are addressed and which ones need further attention. Recommendations to address these issues are provided in Chapter 5.

4.2 Communication and Coordination

For the purposes of this report, communication and coordination has two meanings. First, it means involving and informing local residents regarding oil and gas activities that affect them, including meaningful involvement in project planning, involvement in efforts to mitigate impacts to subsistence, incorporation of local and traditional knowledge into documents, and involvement in research. Second, communication and coordination also relates to efforts by agencies to coordinate reviews of proposed exploration and development projects.

This section begins with an overview of issues related to communication and coordination. It continues with examples of agency initiatives to promote communication and project review coordination. It ends with a discussion of what issues need more attention.

4.2.1 Overview of Issues Related to Communication and Coordination

The major oil and gas-related communication and coordination issues include a need for greater communication and involvement of local residents, a need to respond to reduced opportunities for public comments and a need for better interagency coordination. As summarized in Section 4.2.2 of this report, some agencies are addressing these issues through various means.

Need for Improved Communication: Commenters during the 2006 public meetings for this report expressed the need for greater communication with the villages from both agencies and industry (Appendix A). These concerns were also voiced by members of the NPR-A Subsistence Advisory Panel (Appendix B). While progress has been made by agencies to improve communication, this appears to be an ongoing issue. Area residents have expressed concerns about coordination of research on the North Slope and have called for more local involvement in research planning, design, implementation, and reporting. Residents have also requested more coordination to incorporate local and traditional knowledge into research as well as project-related documents. Due to the importance of local and traditional knowledge, this topic is addressed in more detail in Section 4.2.1.1. It should be noted that while many residents desire to be involved in reviewing oil and gas activities, others have also complained about meeting fatigue from too many community meetings.

Reduced Public Comment Opportunities: The elimination of the Alaska Coastal Management Program (ACMP) and efforts to streamline permitting have reduced opportunities for public comment on oil and gas projects. The ACMP provided important opportunities for public comment on proposed projects (see Section 4.2.1.2 for a description of the ACMP). Over the years, there has been a trend for consolidating the reviews of oil and gas lease sales. For example, the Department of the Interior practice to complete an EIS for each individual lease sale in the Alaska OCS has been replaced by a single EIS for multiple sales in the Chukchi Sea and Beaufort Sea planning areas.²⁹ Since 1996, the State of Alaska has implemented an areawide lease sale process that is good for multiple sales during a ten-year period unless the commissioner of ADNDR finds that substantial new information justifies an amendment to the best interest finding. In 2013, the Alaska State Legislature passed legislation which may allow ADNDR to offer a single comment period for all oil and gas exploration and development in a geographical area for a ten-year period (Chapter 13 SLA 13).³⁰

Need for More Interagency Coordination: While agencies have separate processes for reviewing exploration and development project proposals, there are few interagency processes. Commenters during public meetings for this report expressed a need for more interagency coordination, especially for land use planning. Since termination of the ACMP in 2011, no other program has replaced its interagency coordination procedures. Section 4.2.1.2 summarizes the ACMP project consistency review process.

29: The 2008 Draft EIS for the Beaufort Sea and Chukchi Sea Planning Areas covered four proposed lease sales in the two planning areas (MMS 2008).

30: While nothing in Chapter 13 SLA 13 explicitly authorizes a single comment period for exploration and development, a February 27, 2013 briefing paper for the legislation states: "HB129 will consolidate the Department of Natural Resources' exploration and development approvals . . . The initial comprehensive review of a geographical area gives the public, government agencies and industry an opportunity to participate and identify exploration and development considerations for all subsequent projects. Projects may then move forward within the defined parameters and subject to the lease mitigation measures without additional public review following the geographical area approval process . . ." (House Resources Committee 2013). Regulations for this new law were not in place at the time of publication of this document.



Umiak races in Barrow
(Photo: Gordon Brower)

4.2.1.1 Incorporation of Local and Traditional Knowledge

The NSB encourages agencies and applicants to incorporate local and traditional knowledge into their decision making. Sometimes called by other terms, such as traditional ecological knowledge, the concept refers to the body of knowledge a community has about the area it uses. It includes both first-hand knowledge gained from observations during the lifetime of an individual as well as information passed down through generations by oral tradition. The Iñupiat have survived harsh conditions of the Arctic for thousands of years through their ability to observe natural systems and pass this information on to their children and grandchildren. Survival depended on understanding animal behavior, weather patterns, ice processes and ways to minimize impacts to the environment.

Incorporating local and traditional knowledge into planning and permitting is important to ensure decisions are made with the best information available. This knowledge, combined with good scientific information, will result in informed decision making. The Northern Waters Task Force highlighted the importance of traditional knowledge in a 2012 report:

. . . the local and traditional knowledge gathered by Alaska’s indigenous peoples over thousands of years is critically important to a fuller understanding of our northern ecosystems and the multitude of marine and land-based resources within them (p. 25).

The task force recommended that local and traditional knowledge be incorporated into all relevant areas of Arctic studies.

Most often, science and local and traditional knowledge work hand-in-hand. Both approaches provide useful information that broadens the understanding of an area and its resources. Each is based on a different perspective, however. Traditional knowledge is based on a holistic view of the world that focuses on how things are connected. On the other hand, science relies on theories, tests of hypotheses and peer review of results. While scientific investigations often occur over a limited time period by people from outside the region, local and traditional knowledge is based on generational knowledge constantly updated by local observations.

Occasionally there may appear to be conflicts between what is reported through local knowledge and science. Rather than a cause for alarm, this situation should be viewed as a need for more investigation to understand the basis for the disagreement.

Local and traditional knowledge may be obtained through a review of previous investigation comments during public meetings and hearings, or through direct consultation or project-related research. Local and traditional knowledge should be treated in a respectful manner that is supported by local residents and captures the richness and context of the information (Krenz 2013).

4.2.1.2 Alaska Coastal Management Program (ACMP)

Before its termination in 2011, the ACMP provided an important interagency process to coordinate reviews of proposed projects for coastal areas which included vast inland areas. The program included reviews of oil and gas leasing, exploration and development activities. The mission of the ACMP was to provide stewardship for Alaska's coastal resources to sustain long-term economic and environmental productivity. Established in 1976, the program involved a unique partnership between coastal districts (including the North Slope Borough), the State of Alaska and federal agencies. It provided an opportunity to identify and resolve land and water use conflicts and disputes for over three decades.

One of the major parts of the program involved review of project proposals for consistency with statewide standards and local enforceable policies. Coordinated consistency reviews were conducted for activities proposed on private, state and federal land, and offshore waters. The consistency review process provided a forum for local, state and federal agencies to coordinate their reviews of the projects. While federal agencies were not required to participate in the ACMP, they often did, especially for projects that did not involve an environmental impact statement (EIS). The federal Coastal Zone Management Act provided an incentive for federal participation in ACMP reviews because federal authorizations could not be issued until completion of the ACMP review, and federal activities were required to be consistent with the statewide standards and local enforceable policies.

In addition to providing a meaningful seat at the table for the NSB, the coordinated consistency reviews also provided an opportunity for early identification and resolution of issues. Reviews included an opportunity for comment from stakeholders and the public. In addition, an appeal process gave agencies, local coastal districts and applicants the opportunity to appeal proposed coastal consistency determinations before they were finalized.

Local enforceable policies provided requirements for how projects could avoid, minimize or mitigate impacts to coastal resources and uses. In addition to enforceable policies, the NSB Coastal Management Plan included a wealth of information about coastal resources and uses.

In 2011, the Alaska Legislature did not pass legislation that would have extended the program, and as a result, the program ended. The absence of the ACMP results in a great loss to NSB, especially with regard to the forum it provided to identify and resolve conflicts. Because the NSB's coastal management enforceable policies were adopted into the Borough's Title 19 planning and zoning ordinance, they still apply to projects, including those in the NPR-A. New forums for collaboration and conflict resolution may be needed, however, to fill the void of the loss of the ACMP.

4.2.2 Agency Measures to Promote Communication and Coordination

Although more work needs to be done, agencies have implemented some significant efforts in recent years to improve communication and coordination. Some of these efforts are discussed in the following subsections.

4.2.2.1 Federal Measures to Promote Communication and Coordination

This section highlights five examples of federal processes and initiatives that promote communication, coordination, and interagency collaboration: Environmental Reviews, NPR-A Subsistence Advisory Panel, NPR-A Working Group, North Slope Communications Protocol, and the North Slope Science Initiative. In addition, measures in the 2013 NPR-A record of decision are briefly discussed.

Environmental Reviews: The National Environmental Policy Act (NEPA) requires federal agencies to evaluate and analyze environmental impacts of major federal actions. An environmental impact statement (EIS) is required for activities that significantly affect the quality of the human environment (42 USC 4332, 40 CFR 1501). An environmental assessment is used to determine whether an EIS is needed. The NEPA reviews themselves are not approvals, but they disclose potential environmental impacts. While processes to develop environmental assessments may or may not involve multiple agencies, development of an EIS involves public participation and opportunities for agencies to cooperate in identifying environmental consequences of a project. Agency decisions follow an EIS in documents called records of decisions (RODs).

NPR-A Subsistence Advisory Panel (SAP): The SAP consists of representatives from seven tribal governments and the North Slope Borough. SAP meetings provide a forum for representatives to review oil and gas activities and other projects authorized by BLM in the NPR-A and to make recommendations to BLM on measures to reduce impacts to subsistence. The SAP was established in 1998 and meets three to four times per year with presentations by oil industry and researchers. SAP members communicate issues and concerns from their communities to BLM and provide information from the meetings to the tribal governments they represent.

NPR-A Working Group: In response to comments received on the 2012 draft Integrated Activity Plan (IAP) and EIS, the BLM committed to establish the NPR-A Working Group to enhance input by local residents on implementation of the IAP. This working group includes members from local governments, Native corporations and tribes.

North Slope Communications Protocol: The EPA developed a protocol in 2009 to guide interactions with residents of the NSB: *North Slope Communication Protocol, Communication Guidelines to Support Meaningful Involvement of the North Slope Communities in EPA Decision-Making* (EPA 2009). Appendix B of the protocol describes key steps necessary to improve project communication and coordination, including early communication, strategies for communication, community input, implementation, and adaptive management. Appendix C of the protocol provides background information for travelers to the NSB.

North Slope Science Initiative: The North Slope Science Initiative (NSSI) is an intergovernmental effort to increase collaboration at the local, state and federal levels to address the research, inventory, and monitoring needs as they relate to development activities on the North Slope of Alaska.³¹ The Energy Policy Act of 2005 authorized the creation of the NSSI. The purpose of the organization is to improve scientific and regulatory understanding of terrestrial, aquatic and marine ecosystems for consideration in response to resource development proposals and climate change. Also, the NSSI facilitates information sharing among agencies, industry, academia, organizations, international programs, and members of the public.

NPR-A ROD: In its most recent ROD for the NPR-A, the BLM has provided for many opportunities to consult with the NSB and other entities (BLM 2013b). These provisions are summarized by topic in the below bullets.

- **Consultation by BLM:** The BLM will consult with the NSB prior to approving road construction (BMP E-1), hazardous material contingency plans (BMP A-3), pipeline and road crossings over rivers (Lease Stipulation and BMP K-1) and lakebeds (Lease Stipulation and BMP K-2), and ramps or buried pipelines in the Teshekpuk Lake Caribou Habitat Area (BMP K-5). The BLM will consult with the NSB before developing monitoring studies regarding goose molting areas (BMP K-4A). The BLM may consult with the Borough when approving study design or studies on contaminants (BMP A-11).
- **Consultation Required of Applicants:** Applicants are required to consult with the NSB during preparation of waste management plans (BMP A-2), gravel mine site design and reclamation plans (BMP E-8), aircraft use plans (BMP F-1), free passage of fish monitoring programs for causeways and islands (Lease Stipulation E-3), and training for drug and alcohol policies and communicable diseases (BMP I-1). Applicants are required to consult with the NSB and AEWC before conducting open water activities (BMP K-3

³¹: Additional information about NSSI can be found at <http://www.northslope.org/>

and Lease Stipulation K-6). Also, before submitting an application, applicants must consult with affected communities, the NSB, the NPR-A Subsistence Advisory Panel to discuss siting, timing and methods for operations; to learn about local traditional and scientific knowledge; and to make reasonable efforts to avoid impacts to subsistence, including completion of conflict avoidance agreements (BMP H-1). Workshops must be held with the NSB prior to developing permanent facilities in the Teshekpuk Lake Caribou Movement Corridor and the Southern Caribou Calving Area (BMP K-10). Seismic survey applicants must notify search and rescue organizations, cabin and campsite owners and tribal governments of their locations for the season, and they must notify search and rescue operations on a weekly basis their activities (BMP H-2).

- **Reporting:** Applicants are required to provide the NSB with air quality reports (BMP A-10).

4.2.2.2 State of Alaska Measures to Promote Communication and Coordination

Most state agencies have public comment opportunities during reviews of permits for oil and gas activities. Two state-initiated coordination efforts are highlighted below: Large project permitting and an MOU between the Alaska Department of Natural Resources (ADNR) and the NSB. In addition, coordination requirements from the most recent North Slope Areawide Oil and Gas Lease Sale are summarized.

Large Project Permitting: Within the ADNR, the Office of Project Management and Permitting coordinates state reviews of some large projects. For projects coordinated under this process, the Office provides a single point of contact. Applicants are encouraged to use this process for large transportation, oil and gas, mining, timber, or alternative energy projects.

Memoranda of Understanding (MOUs): MOUs provide a mechanism to promote interagency cooperation. The NSB and ADNR signed an MOU on July 28, 2012 to coordinate oil and gas permitting and promote involvement of the NSB in the State's large project review process for activities on the North Slope. The agreement stipulates that regular meetings will occur with the Office of Project Management and Permitting and NSB Planning staff. It also encourages identification of issues early in the regulatory process. The MOU recognizes the value of enhanced collaboration, communication, and coordination in the review of projects.

Lease Sale Mitigation Measures: The 2008 Best Interest Finding for the North Slope Areawide Sale includes a number of provisions for communication summarized below by topic (ADNR 2008).

- **ADNR Consultation:** The ADNR must consult with the NSB before approval of causeways, docks, artificial gravel islands and bottom-founded structures (Mitigation Measure 1.h.). Consultation is also required before determining that removal of structures and rehabilitation is not in the state’s interest (Mitigation Measure 1.j).³² When enforcing a requirement preventing unreasonable conflicts with subsistence, the ADNR must consult with the Borough and the public (Mitigation Measure 3.a).
- **Applicant Consultation:** A plan of operations must be submitted to all surface owners of property that will be entered (Mitigation Measure 1.a). Before submitting a plan of operations, applicants must consult with potentially affected communities and attempt to reach agreements about measures to reduce impacts to subsistence (Mitigation Measure 3a.).³³ Applicants are required to describe their efforts to communicate with local communities in the plan of operations (Mitigation Measure 7). Unenforceable Lessee Advisory 8 encourages industry to involve residents of communities in their planning process, including during development of plans of operation and oil spill prevention and contingency plans.
- **Use of NSB Information:** Mitigation Measure 6 requires consideration of literature provided by the NSB or its communities when conducting inventories of prehistoric, historic and archeological sites.

The 2009 Best Interest Finding for the Beaufort Sea Areawide Sale also includes a number of provisions for communication that are summarized below.

- **Applicant Consultation:** Mitigation Measure 3.a requires consultation with the NSB, AEWC and affected communities if project activities could potentially affect subsistence use. The consultation must address siting, timing and activities as well as measures to reduce impacts to subsistence. The plan of operations must include information about resolutions reached or not reached and who participated in the discussion. If the parties cannot agree, DNR may be requested to help resolve the issue. Mitigation Measure 3.b. requires that lessees consult with local Native organizations for assistance in contacting subsistence users. Mitigation Measure 3.c requires consultation with the NSB and the community of Kaktovik for activities on specified tracts. Mitigation Measure 7.c requires that a description of consultation with local communities in the plan of operations.

³²: This provision was not included in the 2009 Best Interest Finding for the Beaufort Sea Areawide Sale (Alaska Department of Natural Resources 2009).

³³: This measure is similar to BLM BMP H-1 except that it includes a requirement to consult with local communities and Native organization to identify subsistence users who should be contacted. In addition, the BLM BMP includes language about discovery of local traditional and scientific knowledge, and it mentions conflict avoidance agreements.

4.2.2.3 NSB Measures to Promote Communication and Coordination

This subsection highlights efforts by the NSB to promote communication and coordination, including Title 19 provisions, standard stipulations, and proposed ACMP policies.

Title 19: Pre-application meetings were sometimes used by the Borough in advance of initiating the permit review. The NSB found these meeting to be so valuable that it amended its land use code in August 2012 to require them (NSBMC § 19.50.010). A successful exchange of information during a pre-application meeting avoids costly delays during permitting attributed to requests for additional information. During these meetings, NSB planning staff often recommends ways to streamline the permitting process.

Pre-application meetings can save applicants time when multiple agencies attend them. While other agencies are welcome to attend NSB pre-application meetings, they seldom do so. Under the former ACMP, state and federal agency representatives routinely attended pre-application meetings. This provided a “one-stop shop” for applicants to meet with agency permitters, and it also gave the NSB and agencies a better understanding of potential issues and mitigation required by each agency. This kind of cooperation also provided the opportunity for agencies to consider similar language for permit stipulations.

Standard Stipulations: Standard stipulations applied to permits in 2013 that required communication and consultation are summarized in the following bullets.

- **Orientation:** General Stipulation 2 requires an NSB approval of orientation materials for crews.
- **Reporting:** General Stipulation 12 requires an annual report to the NSB about activities completed during the previous year. General Stipulation 19 requires a report of any complaints filed with the permittee.
- **Alaska Eskimo Whaling Commission (AEWC) Coordination:** Offshore General Stipulation 1 required coordination with the AEWC for air and vessel traffic during whale migration. The Conflict Avoidance Agreement (CAA) Stipulation requires that the permittee complete a CAA with the AEWC and other similar organizations to protect harvest of marine mammals. It also requires that a report of the consultations must be provided to the NSB, including any unresolved conflicts.
- **Subsistence Representative:** Industry has implemented programs to employ subsistence advisors. The Subsistence Representative Stipulations require permittees to employ a subsistence representative who will be present during all field operations. The permittee must provide the representative with transportation and radio or phone communication with the village search and rescue offices and the NSB Planning Department. The stipulations provide thirteen specific responsibilities of the subsistence representative.

ACMP: The NSB's 2007 draft coastal management plan, approved by the Assembly, included two measures to promote local coordination. First, Enforceable Policy A-3 required an analysis of impacts to subsistence based on science and local and traditional knowledge. Second, Policy E-1 would have required applicants to demonstrate that they have worked with local communities and the NSB to avoid or minimize environmental and social impacts when siting facilities.

4.2.3 Conclusions Related to Communication and Coordination

Communication and coordination provides an essential tool to identify and resolve conflicts, to coordinate agency land use planning and project oversight, and to involve local residents. Since the planning began for this project, there have been many improvements to communication and coordination processes. More work needs to be done, especially with regard to slope-wide planning, involvement of communities, and interagency coordination of project reviews.

During initial public meetings for this project, North Slope residents expressed a need for better slope-wide planning. The varying responsibilities of the many different local, state and federal agencies make coordination of planning efforts difficult. The NSB is the only government agency with NSB-wide planning authority through its comprehensive planning responsibilities. The major land management agencies develop plans for areas they manage. BLM completes Integrated Activity Plans for the NPR-A, the National Park Service completes several types of plans for its units, and the USFWS completes Comprehensive Conservation Plans for ANWR. ADNR completes Best Interest Findings for oil and gas lease sales, and in the spring of 2014 it began developing the North Slope Management Plan.³⁴ Although agency missions differ, more efforts are needed to coordinate their review.

The involvement of communities and incorporation of local and traditional knowledge into planning for and management of oil and gas activities is an ongoing task. In recent years, lease sale requirements, permit stipulations and new organizations have improved coordination with communities. Examples of coordination groups include the NPR-A Subsistence Advisory Panel and the recently-created NPR-A Working Group. While communities seek more involvement with land use planning and development, they also report residents have experienced meeting fatigue from too many meetings. This apparent paradox could be addressed by finding more efficient and productive ways to involve communities. For example, the EPA communications protocol provides an example of a proactive approach to conduct communications on the North Slope that is sensitive to the unique concerns of North Slope villages. To address concerns of communities, agencies will need to experiment with new methods to involve locals and incorporate local and traditional knowledge.

³⁴: Although the plan was not completed at the time of this publication, ADNR has designated land use classifications for some state lands on the North Slope through past planning efforts. These classifications may be viewed on the Alaska Mapper program. (http://dnr.alaska.gov/MapAK/browser?map_select=&gsid=C1CED1691C807D7B4278DFCA32426C96.tomcat-90)

The termination of the ACMP in 2011 created a void in interagency coordination during project reviews. The large project permitting process coordinated by ADNR and the associated MOU with the NSB are some examples of institutions working to improve coordination. These processes are not applied to all projects, however, and some recent actions have reduced opportunities for public involvement, such as legislation passed in 2012 that limits public involvement to a single comment period for ADNR actions for exploration and development activities over large geographic areas. New ways to coordinate the efforts of permitting agencies can streamline permitting without reducing opportunities for local involvement. Section 5.2 provides recommendations to improve communication and coordination efforts.

4.3 Tundra Travel

Travel across the tundra is an essential part of the subsistence way of life on the North Slope and is also a critical component of oil and gas operations. In addition to food security, tundra travel is essential for overland transportation of goods and materials, completion of scientific research, and for oil and gas exploration. Historically, the Iñupiat travelled great distances in search of food and materials and to trade goods. With the advent of snow machines and four wheelers, today's subsistence users continue ancient travel patterns, but at a much faster pace.

The absence of a road network throughout most of the North Slope makes tundra travel an indispensable option for oil and gas industry activities, including exploration and support for developments that are off the road system. Companies use tundra travel to conduct exploration activities, including geophysical surveys and exploration drilling, and to conduct maintenance and repairs of pipelines and other development-related facilities.

This section addresses snow roads, ice roads and off-road travel with specialized vehicles. It begins with an overview of issues and continues with background about tundra travel and agency regulation of off-road travel. It concludes with an analysis of what issues are being adequately addressed and what issues need more work. Other types of roads are addressed in Section 4.4.

4.3.1 Overview of Issues Related to Tundra Travel

While tundra travel provides tremendous benefits, it also has the potential to result in some negative impacts. Actual and potential impacts of tundra travel are discussed in this section under five categories: subsistence use, wildlife, habitat, social, and industry impacts.

4.3.1.1 Impacts to Subsistence Use

Cross country travel is essential for local residents in search of subsistence resources needed for food security. The opening of oil industry snow and ice roads to subsistence use provides a

positive local impact. In addition, transportation and freight costs can be reduced for residents that use ice and snow roads to access the Dalton Highway.

One of the most important concerns about tundra travel raised by North Slope residents relates to impacts to subsistence from oil industry uses. Residents have identified the following concerns.

- **Displacement of Wildlife:** Reduced availability of subsistence resources can occur as a result of displacement from noise and traffic.
- **Increased Costs:** Increased fuel costs can occur from having to travel further to get subsistence resources.
- **Safety Issues:** Safety concerns result from having to travel further to get subsistence resources, uneven surfaces at junctions of snow trails and ice roads, and icing of trails resulting from discharge of grey water adjacent to seismic trains.

4.3.1.2 Impacts to Wildlife

North Slope residents have expressed a number of concerns about potential impacts to fish and wildlife from tundra travel and related activities.

- **Noise:** Noise from seismic survey trains and other tundra travel vehicles can impact the distribution and migration of caribou and impact subsistence users.
- **Visual Impacts:** Changes to animal behavior can result from visual impacts of moving vehicles and other tundra travel related activities.
- **Impacts from Water Withdrawal:** Ice roads require significant amounts of water; between 1,000,000 and 1,500,000 gallons of water are needed to construct a one-mile ice road six inches thick and 40 feet wide. Although agencies regulate the use of water, some residents have expressed concerns about impacts to fish and hydrology, including the possibility that during some years there may not be complete recharge to lakes during the spring melt.

It should be noted that significant restrictions on tundra travel use could potentially lead to an increase in air traffic to conduct activities at remote sites. An increase in air traffic could result in greater impacts than from cross country travel.

4.3.1.3 Impacts to Habitat

Early oil and gas exploration on the North Slope damaged the tundra in some areas, but today's best practices mitigate long-term impacts of tundra travel. Early impacts from cross country travel occurred when crude roads were constructed by using material dug from either side of the road. This practice affected the types and distribution of tundra plants and resulted in

thermokarst and creation of new waterbodies. Over time, new methods were implemented, and current practices greatly reduce damage to the tundra. Today, most oil and gas exploration drilling occurs during the winter when the ground is frozen.

Today, tundra damage can occur from both winter and summer off-road travel or ice road construction. Damage from cross country travel occurs if the ground is not frozen enough or if unapproved vehicles are used. Occasionally, some tundra is disturbed during construction of ice roads when high spots on the tundra are inadvertently bladed. While there is a potential for impacts to fish habitat at river crossings, current permit stipulations minimize those impacts.

Properly constructed ice roads can also lead to some plant damage. Studies have revealed that certain types of vegetation are more susceptible to ice road damage than others. ADNR found that Tussock tundra vegetation is much more delicate than sedge vegetation and takes a long time to recover from any disturbance (Bader and Guimond 2005). A 2005 BLM study also found that damage to vegetation was minimal in wetland areas, but some damage to vegetation may occur at higher, drier sites covered by shrubs, forbs and tussocks (Guyer and Keaton 2005). That study concluded that areas used for single-season ice roads can completely recover within 24 years.

4.3.1.4 Social Impacts

In addition to impacts related to subsistence uses, other social effects of industrial tundra travel include both positive and negative impacts.

- **Increased Access:** Ice roads are sometimes used by locals to travel between villages and to reduce high air freight costs for transporting goods, equipment and vehicles.
- **Public Safety:** Increased tundra travel can increase public safety costs. As villagers travel further from home, increased demands on search and rescue and law enforcement occurs.
- **Drugs and Alcohol:** Residents have raised concerns about the influx of drugs and alcohol due to increased access to the Dalton Highway.
- **Historic and Cultural Sites:** Residents have expressed concerns about potential impacts to historic, prehistoric and culturally important sites from tundra travel. Mitigation measures often require pre-activity surveys, avoidance of known historic or culturally important sites as well as procedures to be followed when new sites are discovered.
- **Communication:** Comments from members of the NPR-A Subsistence Advisory Panel and at public meetings for this project reflect the desire by local residents for more communication and involvement regarding oil and gas-related tundra travel. Residents

have requested that companies work with them before selecting routes and to be kept informed about when and where tundra travel has actually occurred. In recent years, improvements have been made to address this issue through increased communication with villages and use of subsistence representatives.

4.3.1.5 Impacts to Industry

The oil industry relies on tundra travel to implement various exploration and development projects that the Borough relies on for its financial wellbeing. Restrictions on tundra travel impact oil and gas companies by limiting the time when overland travel can occur for exploration activities as well as travel to development-related facilities not connected to the road system. This issue became important as exploration activities expanded further from the road system. By 2003, the average number of days of winter tundra had declined from 200 days in the 1970s to less than 120 days (Bradwell et al. 2004). This shortened season was a result of a warming climate, regulatory changes and the methods for measuring frost depth. As explained later in this report, the winter tundra travel season has been expanded based on recommendations and conclusions from studies initiated by the ADNRC (Bader and Guimond 2005, Betula Consulting 2004). These studies led to new techniques to measure ground frost and a better understanding of the ability of different types of tundra plants to withstand travel by off-road vehicles.

While the winter tundra travel season has been stabilized in recent years, a continued warming trend could lead to shortened seasons in the future. In addition, state, federal and local agencies use different processes to determine when the when winter tundra travel can begin, so an opportunity exists to evaluate these processes and determine if there is a need for standardization.

4.3.2 Background

This section provides background about tundra travel, including the types of tundra travel and the evolution of tundra travel management. Section 4.3.3 summarizes current state, federal and local management of tundra travel.

4.3.2.1 Types of Tundra Travel

For the purposes of this report, the term tundra travel is used to describe winter and summer travel off of established gravel roads, including travel across the tundra and use of snow and ice roads. Summer tundra travel occurs for research activities, maintenance of facilities located away from gravel roads, and in response to oil spills.

Packed snow roads, which do not require water, are used for travel by certain vehicles to accelerate tundra travel prior to ice road construction.³⁵ The NSB used pre-packed snow roads prior to ice road construction during its Barrow Gas Field redevelopment project during the winter of 2011-2012. While ice roads require a significant amount of water to construct and maintain, they can be used by heavy vehicles and drilling rigs.

4.3.2.2 Evolution of Tundra Travel Criteria

By opening areas not previously accessible, tundra travel has allowed expansion of oil and gas exploration and development beyond the Prudhoe Bay, Kuparuk, Milne Point, and Alpine project areas. Because low-impact tundra travel technologies have allowed oil and gas development to occur virtually anywhere across NSB, there has been a need to develop and enforce appropriate requirements. This section provides a summary of the evolution of criteria for opening and closing winter tundra travel.

The NSB, ADNR and the BLM have cooperatively worked with industry for several decades to develop best management practices (BMPs) and best available technologies (BATs) for tundra travel. An effort has also been made in recent years to work more closely with residents potentially impacted by tundra travel. Implementation of BMPs and BATs provides an example of how industry and agencies can work together with local communities to mitigate potential physical, biological and social impacts.

Agency requirements have changed throughout time to respond to new technologies and the shortened and increasingly variable season. Local, state and federal government agencies regulate tundra travel, and each level of government has field inspectors that assist in determining appropriate winter tundra travel start and end dates as well as responding to tundra damage.

The criteria for travelling on the tundra have evolved over time. As early as 1975, the federal government established criteria for opening winter tundra travel. Dr. Max Brewer, Director the Naval Arctic Research Laboratory (NARL) from 1956 to 1971, included a tundra travel standard in an EIS for the Navy's exploration of Naval Petroleum Reserve No. 4 (Department of the Navy 1977). The standard established a minimum 12 inch frost depth and six inches of snow cover before commencing winter tundra travel. Dr. Brewer developed the standard based on his experience as an Arctic geologist, engineer and permafrost expert (Alaska Department of Natural Resources 2004).

From 1975 to 1985, ADNR used air temperature and snow depth as the main criteria for opening the winter tundra travel season. Beginning in 1985 and continuing through the mid-

³⁵: Use of trails rather than ice roads can save money. Braumbaugh and Svejnoha (2010) report a savings of four million dollars by use of tracked vehicles to move contaminated materials from a former drill site at Drew Point to a disposal site.

1990s, ADNRC measured ground hardness and frost depth using a device that indicated the depth at which a steel rod broke through frozen soil (Alaska Department of Natural Resources 2004). The agency opened tundra travel across the entire North Slope when this method indicated a 12-inch frost depth.

In 1990, the NSB adopted the 12 inch frost depth and six inch snow depth standard into its Title 19 zoning ordinance. This action aligned local, state and federal winter tundra travel criteria.

In 1995, ADNRC began using a slide hammer penetrometer to measure when the 12 inch frost depth was achieved. The operator of this instrument counted the number of slide hammer drops that it took to penetrate one inch of frost (i.e., drops per inch or DPI). Until 2003, ADNRC staff determined the ground was adequately frozen when an average measurement of 10 DPI was obtained over the entire twelve inch frost depth profile (Alaska Department of Natural Resources 2004).

Investigations by ADNRC during the 1990s found that pre-packing tundra with additional snow and ice could expedite freeze-up to allow some light-weight vehicles early access across the tundra. ADNRC found that pre-packing snow prevents winds from blowing snow from the road. In years with low snow coverage, ice chips from frozen lakes may be used to pre-pack the travel routes. Pre-packing has resulted in early ice road construction in certain locations, such as in the Barrow gas fields and at Umiat.

ADNRC continued its investigations about snow density and vehicle impact in 2002. It selected 30 sites along the ice road system to monitor average snow depth and density. The agency also standardized the weight and size of slide hammer penetrometers to ensure measurements were consistent.³⁶

By 2003, the winter tundra travel season across the North Slope declined by an average of 80 days, from 200 days in the 1970s to less than 120 days (Bradwell et al. 2004). Figure 4-1 summarizes the tundra travel season lengths from 1969-2003.

The declining winter tundra travel season resulted in questions from industry and government regulators about whether the 12 inch frost depth and six-inch snow depth standard was too conservative. In 2003, the ADNRC Division of Mining, Land and Water joined together with the U.S. Department of Energy (DOE) to complete the Tundra Travel Modeling Project (Bader and Guimond 2005). The aim of the study was to develop scientifically valid, peer-reviewed research that identified ways to extend the winter tundra travel season without compromising the environment. The study used tundra test plots during various stages of freeze up and snow conditions to analyze impacts from various types of exploration equipment. A statistical model was developed to analyze data that was collected during a year and a half period (Alaska Department of Natural Resources 2004).

³⁶: The standard for slide hammer penetrometers was set at 20 pounds, with 15 pound slide weights dropping 24 inches. The standard also specified a 9-16 inch shaft diameter and a 3/8 inch tip diameter (Alaska Department of Natural Resources 2004).

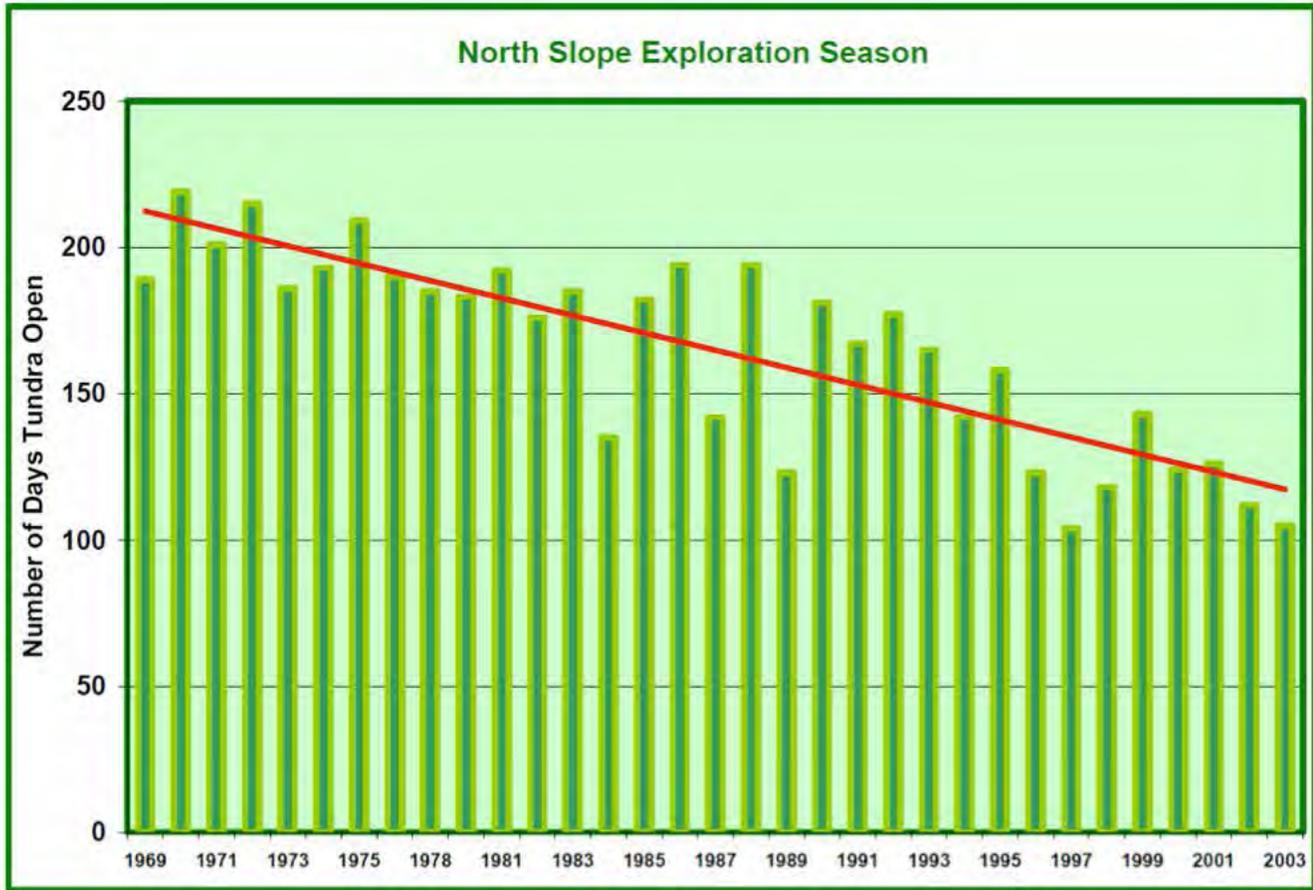


Figure 4-1: North Slope Tundra Travel Season Lengths (1969-2003)
 Source: Bradwell et al. 2004

ADNR found that temperature, soil conditions, tundra type, snow cover conditions, and other site-specific factors varied across the North Slope. Beginning during the 2002-2003 season, four tundra travel management areas for state lands were created on the North Slope: 1) Eastern Coastal Tundra Opening Area (TOA), 2) Western Coastal TOA, 3) Lower Foothills TOA, and 4) Upper Foothills TOA. This management technique allowed some areas to open for winter tundra travel sooner than others. Figures 4-2 through 4-5 show the lengths of winter tundra travel seasons between 2002 and 2012.

The data from 2002-2012 indicate that refining the approach to tundra travel by applying scientifically valid principals resulted in a coordinated effort that appears to have stabilized the length of the exploration season.

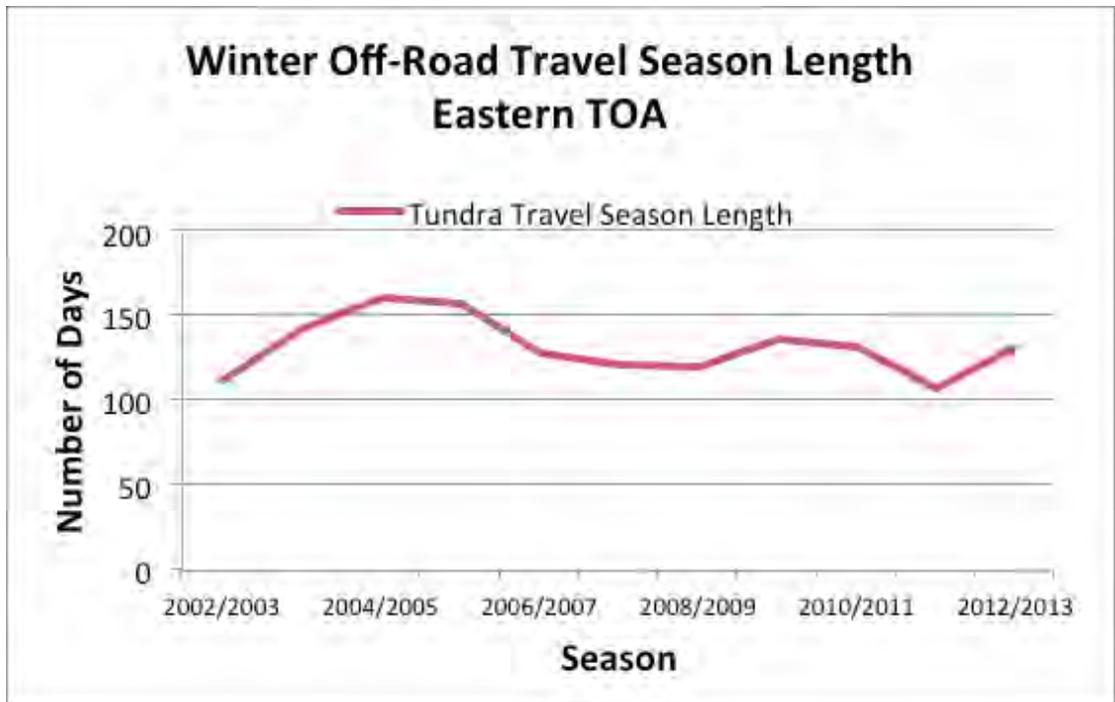


Figure 4-2: Historical Winter Off-Road Travel Season for Eastern Coastal TOA
 Source: Alaska Department of Natural Resources 2013³⁷

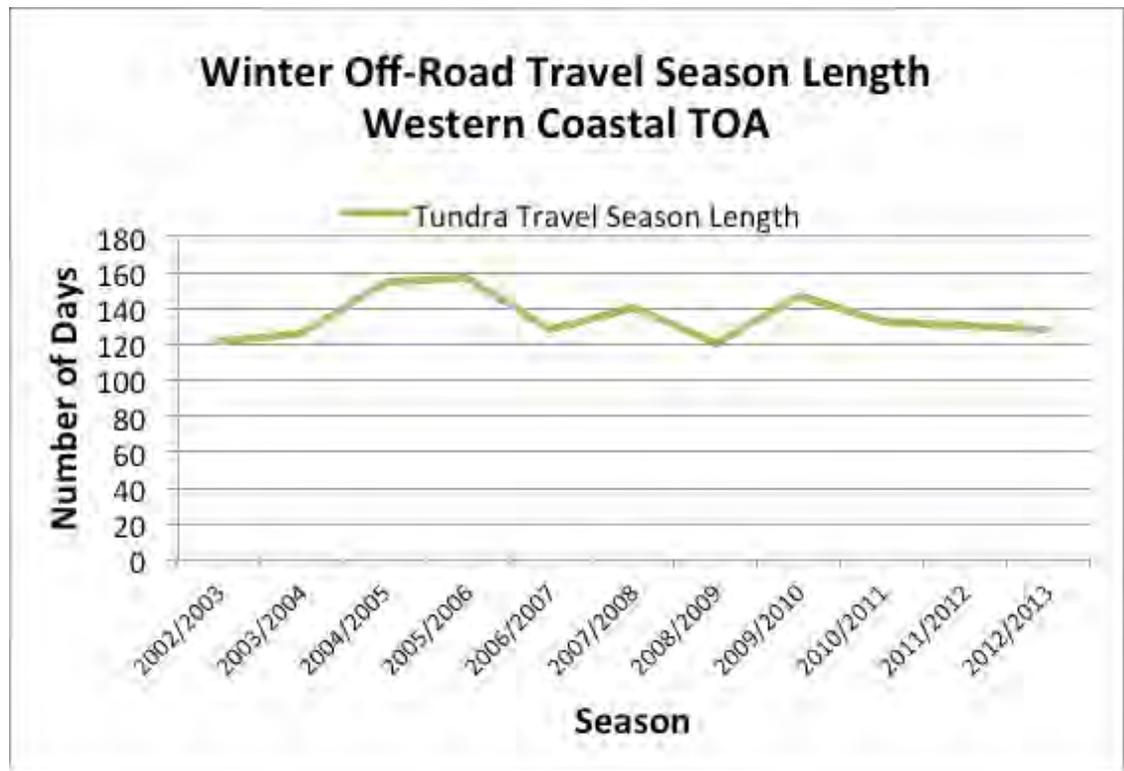


Figure 4-3: Historical Winter Off-Road Travel Season for Western Coastal TOA
 Source: Alaska Department of Natural Resources 2013

37: Data from a spreadsheet provided by Mellissa Head: 2002-2013 tundra travel openings.



Figure 4-4: Historical Winter Off-Road Travel Season for Lower Foothills TOA³⁸
 Source: Alaska Department of Natural Resources 2013

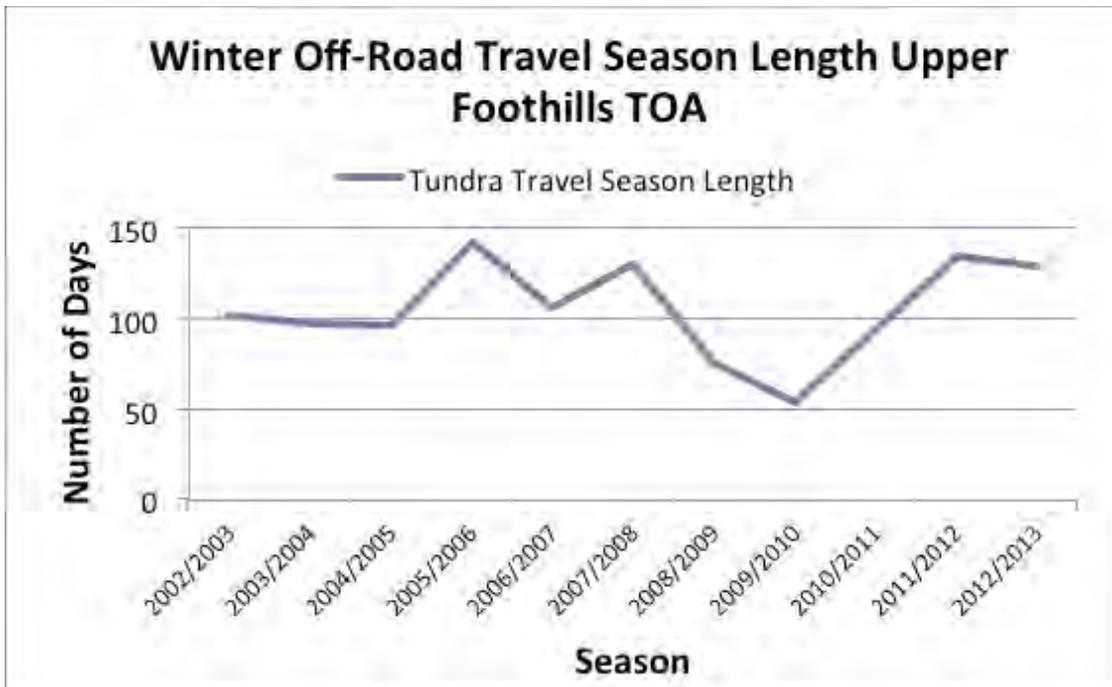


Figure 4-5: Historical Winter Off-Road Travel Season for Upper Foothills TOA
 Source: Alaska Department of Natural Resources 2013

38: The tundra was not opened for this area during the winter of 2009-2010.

The ADNR study found that impacts from vehicles depended on the hardness of frozen ground, depth of snow, the occurrence of hard snow slabs and the type of vegetation. The research revealed that tussock tundra vegetation is much more delicate than sedge vegetation, and it takes a longer time to recover from disturbance. Impacts to the wet sedge habitat common to the Arctic Coastal Plain were dependent on ground hardness and the thickness of snow slabs. For tussock tundra common to the Foothills area, snow cover was the major factor in determining effects to the vegetation.

ADNR changed its tundra travel management approach in 2004 as a result of its research and field experience. The new approach differentiates between the two types of tundra described below and uses a combination of measurements, observations and monitoring criteria (Alaska Department of Natural Resources 2004).³⁹

- **Wet Sedge Tundra:** Cross country travel is allowed when a minimum 15 cm (six inches) of snow cover is available and ground hardness reaches a minimum of 75 drops of the slide hammer to penetrate one foot of ground.
- **Tussock Tundra:** Cross country travel is allowed when a minimum threshold of 23 cm (nine inches) of snow cover and a ground hardness of 25 drops of the slide hammer for one foot of soil penetration have been attained.

Beginning in 2008, ADNR replaced the use of slide hammers with more accurate thermistors to measure frost depth (Head 2011). Thermistors are instruments that use semiconductors to measure temperature. Each thermistor monitors temperatures at the 10 cm, 20 cm and 30 cm depths. Recent applications of this technology by industry involve uploading information from ground thermistors through satellites.

ADNR also actively monitors environmental conditions to determine when it is time to close winter tundra travel.

4.3.3 Regulation of Tundra Travel and Mitigation Measures

This section provides an overview of current state, federal and local management of off-road travel, including mitigation measures required by each level of government.

4.3.3.1 State of Alaska Regulation of Tundra Travel

The ADNR requires permits for all off-road travel on state lands on the North Slope using permit requirements and lease stipulations. It issues permits for a maximum of five years that include stipulations that prohibit tundra vegetation damage. If damage occurs, the permits require rehabilitation to the satisfaction of the ADNR Division of Mining, Land and Water

³⁹: In response to the discovery that the type of tundra determines impacts from tundra travel, the North Slope Science Initiative (NSSI) updated the North Slope Land Cover Map (North Slope Science Initiative 2013a).

(DMLW) (Alaska Department of Natural Resources 2012). ADNR issues permits for summer tundra travel (July 15 to freeze-up) and for winter tundra travel (freeze-up until break-up). No off-road travel is permitted between breakup and July 15 except for emergency situations. The current management approach is described in the remainder of this section.

Area Approach for Managing Tundra Travel: As mentioned in the previous section, ADNR amended its previous practice of managing the entire North Slope as a single unit by using four management areas:

1. Eastern Coastal TOA,
2. Western Coastal TOA,
3. Lower Foothills TOA, and
4. Upper Foothills TOA.

This approach allows ADNR to consider area-specific conditions when opening tundra travel. For example, during the relatively low snowfall winter season of 2007-2008, ADNR opened tundra travel in the Western Coastal TOA on December 28, the Upper Foothills TOA on January 4, and the Eastern Coastal and Lower Foothills TOAs on January 16. In response to low snowfall in late 2007, ADNR allowed industry to pack snow and use ice chips which allowed ice road construction to begin in mid-November.

ADNR's 2013 Criteria for Opening Winter Tundra Travel: ADNR proactively manages winter tundra travel by monitoring snow accumulation, soil temperature, air temperature, and snow/ice surface conditions. Using thermistors to measure ground temperature, it opens the winter tundra travel season when the following conditions occur: ground temperature at 30 cm (12 inches) below the surface reaches a temperature of -5°C (23°F), and at least six inches of snow cover over wet sedge tundra and nine inches of snow cover over tussock tundra.

ADNR reports that the first date of winter tundra travel has historically ranged from as early as November 4 to as late as January 25. Once the tundra has been opened in the winter, there are no restrictions on the type of vehicles that may operate on the tundra under a permit. In the event of limited snowfall, the tundra may be opened conditionally, restricting the operation of vehicles to areas where snow is deep enough to prevent tundra damage.

Ice Road Requirements: As described in Section 4.3.2, ice roads require significant amounts of water to construct and maintain. ADNR works with the Alaska Department of Fish and Game (ADF&G) to develop water withdrawal criteria for the North Slope with consideration of lake depth, presence of fish, and ability of the area to recharge the lakes during breakup. The ADNR issues water use permits, and the ADF&G issues fish habitat permits. The agencies also prescribe standards for four categories of water sources on the North Slope as described below.

- 1. Non-Fish-Bearing Lakes or Ponds:** Water withdrawal allowed up to a maximum of 20% of the total calculated lake volume as either water withdrawn or as ice chips harvested, leaving 80% of the total volume of water/ice intact.
- 2. Lakes with Non-Sensitive Fish Species** (Alaska blackfish and Ninespine stickleback): A maximum of 30% of the under-ice volume of water below five feet of ice cover is available for winter water withdrawal for lakes on the North Slope with non-sensitive species.
- 3. Lakes with Sensitive Fish Species** (Arctic grayling, Whitefish, Burbot, and Lake trout): For North Slope lakes with sensitive species, a maximum of 15% of the under-ice volume of water below seven feet of ice cover is available for winter water withdrawal.
- 4. Rivers and Streams:** The agencies seldom allow winter withdrawal of water from rivers and streams, and when it is allowed, several seasons of detailed information is needed about fish use, bathymetry and water chemistry of the applicable reach of the river. Also, monitoring of water chemistry may be required during and after periods of water withdrawal. Ice aggregate harvest from rivers or streams is sometimes approved on a case-by-case basis for portions of a river where the ice is frozen to the streambed (Winters 2013).

ADNR requires use of water intake screens to minimize uptake of fish. Screens must have a maximum 0.25 inch mesh, and water velocity along the intake structure may not exceed 0.5 feet per second. Smaller mesh sizes may be required in spring and summer where whitefish or grayling fry are present (Winters and Plett 2011 pers. Comm.).

2008 North Slope Areawide and 2009 Beaufort Sea Areawide lease stipulations regarding tundra travel-related activities are summarized in the following bullets.

- North Slope Areawide and Beaufort Sea Areawide Mitigation Measures 2.a, 2.b and 2.c provide criteria for crossing fish-bearing waters and removal of water from fish-bearing waters.
- North Slope Areawide and Beaufort Sea Areawide Mitigation Measure 5 require use of ice roads for exploration, and specify that snow and frost depths must be sufficient to protect the ground surface. Also, the measures address summer tundra travel and allow restriction of public access only within the immediate vicinity of facilities.

ADNR's 2013 Criteria for Closing Winter Tundra Travel: ADNR determines the end of the winter tundra travel season by monitoring the soil temperature, air temperature and snow and ice conditions. The soil temperature at 30 cm (12 inches) below the surface may remain at -5 °C (23°F) while the surface air temperature begins to warm and degrade snow and ice conditions. ADNR staff closely monitors air temperature and physically inspect the surface snow and ice conditions to determine when the snow begins to deteriorate. Deteriorating snow conditions are a good indicator that the tundra travel season is coming to an end, and ADNR provides industry with 72-hour notice during this period.

Summer Travel Requirements: ADNR permits summer tundra travel using approved low-impact, tundra-certified vehicles.⁴⁰ It typically limits travel from July 15 to freeze-up and applies stipulations to summer permits that require operators to use dry uplands when possible with minimal crossing of wetlands. These stipulations also limit multiple passes over the same route.

4.3.3.2 BLM Mitigation Measures for Tundra Travel

Although BLM used to depend on a specific snow and frost depth for tundra travel, it transitioned to a performance-based approach in the early 2000's in response to its experience, requests from industry, and a number of years of low snowfall (Walker 2011). The new approach was chosen after a low snowfall season would have shut down winter tundra travel. The air temperature was cold, however, and soils were frozen more than 12 inches deep. Both BLM and industry had experience operating in low snow conditions and found that the tundra could be protected through careful environmental monitoring and use of appropriate equipment and best management practices, such as pre-packing routes with snow.

Current BLM Criteria for Tundra Travel: Unlike the approach by the State of Alaska, the BLM currently relies on the operator to propose a winter tundra travel start date, based on field monitoring and an implementation plan. It requires the operator to install thermistors and weather monitoring stations and to conduct field tests prior to proposing a start date. BLM uses USGS meteorological and monitoring station data to verify that an operator's field measurements are accurate, and it monitors actual operations to ensure the implementation plan does not result in tundra damage (USGS 2014). In some cases BLM still uses the hammer slide penetrometer to gather site-specific frost depth data. BLM believes this new performance-based tundra travel program continues to protect the tundra while providing industry with more flexibility when to begin tundra travel (Walker 2011 pers. com.).

2013 NPR-A Tundra Travel Limits: The 2013 ROD for the NPR-A Integrated Activity Plan includes criteria for tundra travel that are applied on BLM permits. BMP C-1 requires avoidance of occupied grizzly bear dens by one-half mile and by one mile for polar bear dens or seal birthing lairs. BMP C-2 identifies practices to minimize damage from tundra travel as summarized in the following bullets.

- Frost and snow cover must be at sufficient depths before winter travel is opened. The BLM authorized officer will require operators to cease winter travel when 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).⁴¹

40: Permitted summer tundra travel is limited to vehicles that have been tested and approved by ADNR. The purpose of vehicle testing is to determine which vehicles can operate on the tundra during the summer without causing damage. Vehicles are approved in the configuration tested; for example, a vehicle tested with a payload of 1000 pounds would be limited to that payload when operating in the field. A vehicle tested and approved with smooth tracks would require retesting if the vehicle is to be operated with wheels or cleats (Alaska Department of Natural Resources 2012).

41: BMP L-1 allows BLM to permit summer travel for low ground pressure vehicles during other times if studies indicate no damage will occur to soils and vegetation.

- Low-ground-pressure vehicles must be used for travel off of ice roads or pads. Vehicles must not shear, scrape, or excessively compact the tundra mat.
- Vehicles, other than those with low ground pressure, must avoid using the same trails for multiple trips.
- Ice roads must minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Road offsets may be required ice roads in subsequent years.
- Off-road travel may not occur within buffer areas of certain rivers to protect raptors.

Other restrictions include: crossing of waterways using a low angle approach and removal or breaching of ice bridges (BMP C-3), prohibiting most travel on frozen stream beds (BMP C-4), and requiring certain practices for vibroseis-based seismic surveys above fish-bearing waters (BMP C-5).

Water Use Restrictions: No water may be removed from rivers and streams in the winter, but ice aggregate may be allowed from grounded ice areas less than or equal to four feet (BMP B-1). Winter water and ice aggregates may be removed from lakes based on site-specific conditions (BMP B-2).

Summer Tundra Travel: BLM also provides very specific guidance on summer vehicle tundra access in Lease Stipulation L-1. Instead of maintaining a list of approved summer tundra travel equipment, BLM allows an operator to propose equipment that can be used in summer conditions without damaging the tundra. It may require studies and subsistence surveys along with a summer tundra vehicle access plan.

4.3.3.3 NSB Mitigation Measures for Tundra Travel

The NSB requires land use permits for all tundra travel other than snow machines weighing less than 600 pounds. When developing tundra travel permits, the NSB Planning Department consults with the NSB Department of Wildlife Management and the nearest affected village to identify the lowest impact route. The Planning Department also uses GIS information, and some cases, it conducts site visits to locate the route in areas of resilient vegetation types and around sensitive areas. Knowledge of local hydrology, topography, and water resources is an important factor in choosing the lowest impact route.

Within designated *village areas of influence*, the operator is encouraged to work with affected communities to identify transportation routes and to mitigate impacts.

Title 19: NSB Municipal Code (NSBMC) 19.50.030(J) and (O):

- Prohibits blading or removal of the tundra vegetative cover,

- Requires use of snow ramps, snow or ice bridges or cribbing for crossings over frozen water bodies to protect stream banks,
- Requires removal or breaching of snow and ice bridges and removal of cribbing removed prior to spring breakup,
- Requires crossings be sited at shallow riffle areas, or where they do not exist, an environmentally preferred location, and
- Requires a minimum of six inches of snow or ice on 12 inches of frozen ground for tundra travel to begin.⁴²

Permit Stipulations: In addition to the Title 19 requirements noted above, NSB permits for exploration and development typically include the following standard stipulations.

- **Transportation Plan:** General Stipulation 1 requires preparation of and compliance with various plans, including a transportation plan.
- **Landowner Approval:** General Stipulation 11 requires landowner approval before commencing travel across Native-owned or public lands.
- **Completion Report:** General Stipulation 13 requires a completion report 60 days after termination of a permit that reports on the actual travel routes, camps, list of vehicles used, and documentation of clean-up activities, if applicable.
- **Tundra Travel:** Eighteen Tundra Protection stipulations require using snow ramps and ice bridges, using existing roads where possible, avoiding willow stands, employing tundra specialists, and using of approved vehicles. The stipulations allow pre-packing of routes.
- **Routes and Water Withdrawal:** Three Ice Road, Ice Pad and Airstrip Stipulations require landowner approval, identification of routes and limits on water withdrawals that would impact subsistence resources. In addition, the stipulations repeat the Title 19 frost and snow depth requirements as well as a thickness of six inches for ice roads.
- **Geophysical Surveys:** Onshore seismic stipulations prohibit preclusion of subsistence user access and require minimization of impacts to fish and wildlife, location of camps in areas of adequate snow cover, avoidance of multiple passes along same route, and avoidance of Native allotments. A 72-hour notice of closure may be given after April 15.
- **Polar Bear Consultation:** Specific Animal Stipulation 2 requires consultation with the U.S. Geological Survey about potential polar bear dens.

⁴²: This requirement is likely conservative as a study by the Cold Regions Research and Engineering Laboratory (2005) concluded that off-road travel can cause minimal disturbance when thaw depth is less than 6 cm.

- **Subsistence Representative:** The Subsistence Representative Stipulations require permittees to employ a subsistence representative who will be present during field operations, including most tundra travel activities. Requiring operators to hire community subsistence advisors during seismic operations has reduced conflicts with locals and lessened potential impacts to wildlife and subsistence hunters. The stipulations identify 13 specific responsibilities of the subsistence representative.
- **Historic and Prehistoric Resources:** These standard stipulations require that tundra travel routes be surveyed to identify critical sites, including Traditional Land Use Inventory and Alaska Heritage Resources Survey sites. The stipulations apply to sites located within a 500-foot buffer.

The Planning Department often monitors tundra travel by sending its inspectors to field operations to observe construction and operation and to inspect the areas for tundra damage upon completion at the activity. The standard stipulations require industry to report tundra damage, take photos of the damage and propose a remediation plan. There are no specific standards for remediation; instead, industry develops a plan using a range of methods and techniques, and the Planning Department reviews and approves the remediation. Planning Department staff routinely inspect sites to determine how successful a remediation plan is in achieving the agreed upon objectives.

Coastal Management: The 2007 draft Coastal Management Plan included a few enforceable policies that addressed tundra travel activities. Policy D-4 required applicant to incorporate BAT into project descriptions to prevent damage to permafrost soils. It also required that measures be included in the project description to monitor effects of tundra travel and to avoid damage, including timing of travel and developing a schedule for use of different types of vehicles. Policy E-2 required applicants for geophysical surveys to include information in the project description about measures to prevent impacts. Policy H-2 required use of ice bridges to allow free passage of fish.

4.3.4 Conclusions Related to Tundra Travel

Since the first oil and gas exploration efforts on the North Slope, government agencies have greatly reduced impacts to tundra by requiring most exploration efforts to occur in winter months when the ground is frozen. Agency management of winter tundra travel has evolved over the years, most recently by the use of more reliable equipment to measure frost depth. In 2002, the State of Alaska began evaluating a new system to manage winter tundra travel, and in 2004 it divided the North Slope into four management areas using specific snow and frost depth criteria. It also oversees ice road construction and allows summer tundra travel for approved vehicles. Rather than officially opening the tundra for winter travel, the BLM relies on operators to propose winter travel dates based on field monitoring and an implementation plan.

Instead of maintaining a list of pre-approved summer tundra travel vehicles, the BLM reviews specific proposals by operators. The NSB requires minimum frost and snow depths for winter travel. While it has not updated tundra travel requirements in the Title 19 zoning code since 1990, it provides more specific requirements in standard stipulations applied to permits.

Impacts related to tundra travel have been reduced over the years by implementation of conditions on leases and agency permits. Concerns of subsistence users have been reduced through increased efforts by industry to consult with affected villages and by use of subsistence observers during field operations. Agencies use specific water withdrawal criteria to ensure water used for ice roads does not adversely impact overwintering fish. Agency field inspectors monitor operations to make sure permit conditions are enforced and damaged areas are adequately restored. Impacts to industry from a declining winter season have been addressed through research and improved management measures.

While coordinated efforts to optimize tundra travel have preserved the critical exploration season, a number of issues related to tundra travel still need more attention. An expanded winter travel network has resulted in increased public safety needs and questions about who is responsible for abandoned vehicles. More work needs to be done to ensure operators cooperate to share ice roads in an effort to minimize impacts. Additional efforts may be needed to improve requirements for rehabilitation and restoration of damaged tundra. While management improvements have been made to maximize the winter tundra travel season, continued warming trends could lead to a need for new approaches in the future. Lastly, an evaluation of the different agency approaches to managing tundra travel would be useful to determine if new improvements to those approaches or standardization of approaches would be desirable. Recommendations for tundra travel are included in Section 5.3 of this report.

4.4 Roads

This section addresses roads on the North Slope other than ice roads and snow roads. Most established roads are located within the Borough's eight communities and in developed oil fields. The NSB maintains about 100 miles of roads (NSB 2005). The Dalton Highway provides the only link between the NSB and the Alaska Highway system.

While there are significant mineral resources on the North Slope, including extensive coal deposits near Point Lay, development has been restricted to oil and gas resources. To date, roads for oil and gas development have been limited to the Dalton Highway, the Prudhoe Bay and neighboring developments and within developments not connected to the road system. An approximately 222-mile oil field road system connects to the Dalton Highway at Deadhorse. The Alpine, Badami and Point Thomson development projects are considered roadless developments although they contain roads within the immediate area of the developments. New roads are currently being planned from the Alpine Development Project to access satellite

fields within the NPR-A and new roads may be needed for future oil and gas developments outside or near the NPR-A.

The remainder of this section focusses on roads already constructed or needed for oil and gas development. After an overview of issues related to roads, this section continues with information about the Dalton Highway, and proposed new roads. It concludes with an analysis of what issues have been adequately mitigated and which ones need more attention. The next chapter provides recommendations for addressing road-related issues (see Section 5.4).

4.4.1 Overview of Issues Related to Roads

Roads on the North Slope bring both opportunities and conflict. On the one hand, roads provide access for development of natural resources and access by village residents to subsistence resources. Winter routes, discussed in the previous section, link some communities to the Dalton Highway which reduces the high transportation costs of air freight. On the other hand, NSB residents have expressed concern about impacts of roads to subsistence, wildlife, human health, and their way of life.

Impacts to Subsistence: Roads have both positive and negative impacts for subsistence users.

- **Access to Subsistence Resources:** Roads provide easy access to subsistence resources. If roads are closed to subsistence users, however, they can reduce a community's access to its traditional use area. While some oil field roads are open to subsistence users, others are closed or have limited access due to conflicts with industrial traffic. In addition, national security concerns have the potential to limit local access, such as what occurred after the September 11, 2001 terrorist attacks (NSB 2005). Alpine roads are not currently restricted to subsistence activities.
- **Access to Outside Users:** NSB residents have expressed concerns about increased competition for subsistence resources if roads are opened to hunters from outside the region. Section 4.4.3 provides additional information about potential impacts of new roads.
- **Impacts to Wildlife:** Most research on the impacts of oil industry roads focus on the crossing success of caribou, but impacts could also affect other species. Factors related to road crossing success of caribou include the type of infrastructure nearby, the amount of traffic and type of vehicles, the kinds of habitat around the road, the season, and the age, sex and number of caribou in a group. The following bullets summarize conclusions of three reports that synthesize findings of previous studies (Lawhead et al. 2006, Wolfe et al. 2000, and Cronin et al. 1994).

- **Highest Sensitivity:** Cows with calves during the spring and summer have the greatest potential for disturbance of any caribou group. Roads through calving areas can displace calving caribou up to 6 km (e.g., one study found that concentrations were reduced by 78% within 1 km of roads and increased 321% within 5-6 km of roads). Cows with new calves avoid roads with relatively low levels of traffic (<100 vehicles/day).
- **Traffic:** Traffic is the most important factor, and high traffic may provide a partial or complete barrier to caribou movement. Traffic of 60 or more vehicles per hour impedes crossings.
- **Roads with Pipelines:** Roads sited next to pipelines can impede crossings. Roads with traffic of 15 vehicles or more per hour combined with pipelines creates a synergistic effect that reduces crossing success.
- **Collisions:** Collisions with vehicles can lead to caribou injury or mortality.
- **Habituation:** Caribou, other than females and young during and immediately after the calving period, can become habituated to some kinds of disturbance.
- **Lowest Sensitivity:** The groups least likely to be disturbed include bulls in general and all caribou during periods of insect harassment.⁴³
- **Visual Impacts:** The appearance of roads may provide a barrier (e.g., raised roads or roads with snow berms). Moving vehicles may also trigger a defensive response because of the association of movement with predators.
- **Combined Stressors:** Herds using poor quality habitat or those exposed to multiple types of disturbance are less resilient to stress.
- **Coastal Facilities:** Transportation corridors along the coast have limited impacts to caribou because they may not need to cross the roads to reach insect relief areas.

Impacts to Habitat: Roads can alter habitats in a number of ways. Changes to drainage patterns may result in flooding, especially where roads cross low-lying areas. These hydrological impacts can lead to changes in the types of plant communities. Likewise, snow drifts caused by roads can lead to vegetation changes. Dust has also been found to contribute to thermokarst along North Slope Roads because the darker surface of snow absorbs more heat and leads to melting of permafrost soils (Walker et al. 1987). Studies on the North Slope found that up to 10 inches of dust were deposited along the Spine Road and that all

⁴³: During periods of insect harassment, caribou may also use gravel pads in oil fields because the winds on elevated pads reduce insects.

vegetation died within 15 feet of the sides of some heavily travelled roads (National Research Council 2003). Roads can also increase the introduction of non-native plants. In addition, river and stream crossings have the potential to impact fish habitat by changing natural drainage patterns, impacting water quality from increased siltation and bank erosion. Borough permit stipulations address these potential impacts.

Health and Social Implications: Residents have expressed concerns about potential increases in alcohol and drugs from seasonal or permanent roads proposed in the NSB. Residents and Borough officials have expressed concerns about being disenfranchised from transportation decision making processes (NSB 2005). In addition, gravel roads produce dust which can reduce the air quality and pose potential health concerns.

Economic Impacts: Other than roads within villages, industrial development drives the need for new roads in the NSB. Construction of the Dalton Highway and infield roads on the North Slope has allowed the essential development of oil and gas resources. In addition, seasonal connections between some villages and the Dalton Highway help the local economy by reducing transportation costs for general travel and for transporting vehicles and other goods.

Additional concerns raised during scoping for an EIS for a proposed road to Umiat are discussed under Section 4.4.3.

4.4.2 Dalton Highway

The Dalton Highway was completed in 1974 as a supply route for the Trans-Alaska Pipeline System and Prudhoe Bay. It begins north of Fairbanks near Livengood and terminates at Deadhorse. A 1978 MOU signed by Borough Mayor Eben Hopson, Sr. and Governor Jay Hammond established management principles for the highway. In addition, a 1980 NSB policy plan and the 1998 Dalton Highway Master Plan address issues related to the transportation corridor (State of Alaska 1998).⁴⁴

While originally limited to commercial traffic, part of the route was opened for public use in 1981, and the entire route to Deadhorse was opened in 1994. Additional management documents have been developed by the NSB, State of Alaska and BLM. The north 180 miles are within the boundaries of the NSB.

Issues related to the Dalton Highway include off-road use, impacts to subsistence, and impacts to migrating caribou from highway traffic. State law currently prohibits off-road vehicle use within five-miles of the right-of-way north of the Yukon River (AS 19.40.219). There has been proposed legislation considered by the Legislature, however, to repeal this ban. While hunting

⁴⁴: The Master Plan recommended that initial development to occur at five nodes: Yukon River Crossing, Coldfoot, Chandalar Shelf, Happy Valley, and Deadhorse. The plan called for public service facilities and market-driven commercial facilities. The committee that wrote the plan envisioned that an interagency group would implement the plan composed of the NSB, Tanana Chiefs Conference, Stevens Village, the BLM, and the Alaska departments of Natural Resources and Transportation and Public Facilities

with firearms is prohibited in the corridor, limited bow hunting is allowed. In addition to subsistence concerns, residents worry about increased litter, dust on vegetation, trespass, and public safety issues (NSB 2005, NSB 1980b).

The NSB manages land uses along the Dalton Highway through its Title 19 zoning code. It has zoned the Dalton Highway as a Transportation Corridor district with specific policies for the corridor (NSBMC § 19.40.090). In addition, the Borough's Comprehensive Transportation Plan identifies policies to implement its objective to manage growth along the corridor to ensure adequate public safety, wildlife management and subsistence resource protection (NSB 2005).

4.4.3 Proposed New Roads

Proposed new roads have mixed support from Borough residents. Roads related to oil and gas or mineral development would support development, which would lead to an expanded tax base for the Borough. New roads also have the potential to provide easier access to subsistence resources for residents, but if opened to outsiders, they could result in increased competition and pressures on wildlife populations. In addition, road connections to the Dalton Highway could reduce the high costs of transportation of goods and materials to villages, as well as general travel.

Throughout the years, there have been a number of new road corridors discussed for expanding the road network in the NSB. Some residents of Nuiqsut, Anaktuvuk Pass and Kaktovik have expressed interest in connecting their villages to Dalton Highway while other residents oppose such roads (NSB 2005). In addition, a joint strategic plan approved by the planning commissions of the NSB and Northwest Arctic Borough (2011) included a potential road to connect the coal fields near Point Lay to the Red Dog Mine road. The most recent investigation into new road connections, however, is the Foothills West Transportation Access project which would connect the Dalton Highway with Umiat.

At the time this report was written, the scoping document for the draft EIS for the Foothills West Transportation Access Project was delayed until Umiat operator Linc Energy determines whether they will go forward with the project. This will depend on whether they can get flow from test wells at Umiat during the winter 2013/2014 season. If Linc has successful well test results and still wants a combined project, project scoping could commence when an application has been submitted to the Corps of Engineers.

The all-season road is proposed to start near Galbraith Lake on the Dalton Highway and continue east to Umiat. The road would be about 100 miles long, and the corridor would include about 3,940 square miles. The purpose of the road is to encourage exploration and development of oil and gas resources. Oil was discovered at Umiat in 1946 and lessee Linc Energy, LLC estimates up to 194.5 million barrels of oil are recoverable from approximately 1 billion barrels of oil in the field (Nelson 2008). Additionally, the National Energy Technology

Laboratory (2009) estimated that there are 654 billion cubic feet of technically recoverable gas at and near Umiat, including the Gubik field discovered in 1951 and the East Umiat field discovered in 1964.

The U.S. Army Corps of Engineers held scoping meetings in Fairbanks, Anchorage, Nuiqsut, Barrow, and Anaktuvuk Pass for the proposed Umiat road between May and July 2011. It received 149 comments addressing a number of issues as summarized in the following bullets (U.S. Army Corps of Engineers 2012).

- **Biological Resources:** Comments on this topic focused on potential impacts to subsistence resources, including caribou, moose, bear, fish, and plants. Specific impacts included noise, spills, dust, and harassment of animals by hunting and recreation activities.
- **Subsistence:** Concern was expressed about potential impacts to subsistence uses and to the migration patterns of caribou and other animals. Commenters mentioned potential impacts from increased recreational use, including hunting, boating, snow machining, and off-road vehicles. Some were concerned that more recreational hunting would put too much pressure on caribou populations. If the road disturbed subsistence species, hunters would have to travel further from the village at increased risks of accidents and injury.
- **Land Use Management:** Comments questioned how laws would be enforced, how refuse would be cleaned up, and what government entity would fund management of the area. A few commenters recommended public use of the road since it would be built with public funds.
- **Economic Issues:** Proponents of the project cited local and state benefits while opponents said the costs of building the road were not offset by the benefits. Some people recommended all costs, including long-term maintenance, be considered.
- **Sociocultural Systems:** Citing the experience of Nuiqsut, some commenters cautioned against potential lifestyle changes to the people of Anaktuvuk Pass. Concerns were expressed about impacts to the culture through reduced subsistence use. Some comments addressed the potential for increased drugs and alcohol as a result of the road as well as the spread of disease.
- **Oil, Gas and Minerals:** Some comments included benefits and impacts related to development of oil and gas as well as coal.
- **Water Resources:** Comments addressed potential impacts of bridges and culverts on stream flows, wetlands and floodplain habitats.

With the progression toward phased development of the Mooses Tooth Unit and the recent new discoveries in the Bear Tooth Unit, new roads within the NPR-A are imminent. By 2018, villagers in Nuiqsut may be able to drive on a permanent road across a Colville River bridge to points 15 miles further west. Pending successful development within the Bear Tooth Unit, the road system may be extended another 15 miles west, roughly 115 miles from Barrow.

With recent discoveries in the area between the Kuparuk River and Colville River units by Repsol, Pioneer Natural Resources⁴⁵ and Brooks Range Petroleum, it is conceivable that the road infrastructure will expand.

Developing the oil and gas resources essential to the Borough will require comprehensive and coordinated planning to construct the most efficient and least intrusive industrial transportation system possible.

4.4.4 Mitigation of Road Impacts

This section provides an overview of measures the BLM, ADNR and NSB use to mitigate impacts to road issues raised in Section 4.4.1. In addition to the measures required by agencies, companies can also mitigate impacts. For example, for the Greater Mooses Tooth 1 development, ConocoPhillips has proposed to construct parking areas along the side of roads for the convenience of subsistence users.

4.4.4.1 BLM Measures to Address Road Impacts

Many lease stipulations and best management practices (BMPs) in the 2013 Record of Decision (ROD) for the NPR-A address some aspects of roads (BLM 2013b). Both lease stipulations and BMPs are enforceable, although the ROD allows deviations from the requirements if the BLM determines an alternative procedure would meet the objective of the stipulation or BMP.⁴⁶

- **Information:** GIS shape files must be provided for roads (BMP E-15).
- **Exploration:** Lease Stipulation D-2 prohibits construction of permanent gravel facilities for exploration.
- **Monitoring:** BMP A-1 includes a provision for requiring one year of baseline ambient air monitoring data for roads and other facilities.
- **Avoidance or Minimization of Impacts:** Chasing wildlife with vehicles is prohibited (BMP M-1). Roads must minimize environmental impacts and protect subsistence uses and access (BMP E-1), and the network of roads between pads must be minimized

⁴⁵: On October 25, 2013, Pioneer Natural Resources announced the sale of all of its Alaska assets to Caelus Energy, LLC.

⁴⁶: Lease stipulations are included on leases, and BMPs are included on permits.

(BMP E-5). Roads must ensure free passage of fish, reduce erosion and maintain natural drainage at stream and marsh crossing. Bridges over rivers are preferred to culverts (BMP E-6). Three years of hydrologic and fish data must be collected for stream crossings below the ordinary high water mark (BMP E-14). Roads must be sited to minimize impacts to nesting and brood-rearing eiders, and power and communication lines must be buried in access roads or suspended on VSMs to prevent bird collisions (BMP E-11). In order to prevent introduction of invasive species, all vehicles and equipment must be certified to be weed free. Also, a plan is required for cleaning vehicles, monitoring weeds and weed control.

- **Buffers and Distance Requirements:** Permanent roads are prohibited within 500 feet of fish-bearing waters (Lease Stipulation E-2). Roads must allow free passage of caribou and shall be sited a minimum distance of 500 feet from pipelines (BMP E-7).
- Prohibitions on Siting within Special Areas:
 - Roads are prohibited in or adjacent to certain rivers, although essential crossings may be allowed (Lease Sale and BMP K-1).
 - Roads are prohibited on the lakebed or within ¼ mile of the high water mark, although essential roads may be considered on a case-by-case basis (Lease Sale and BMP K-2).
 - Roads are not allowed within one mile of goose molting lakes and convoys or specific types of vehicles may be required between June 15 and August 20 (BMP K-4A).
 - Linear corridors within the Teshekpuk Lake Caribou Habitat Area must be oriented to address adverse effects on caribou migration, including corralling effects. Ground restrictions apply during specific times of the year, and caribou monitoring is required when preparing a vehicle use plan (BMP K-5).
 - Linear corridors within the Utukok River Uplands Special Area must be oriented to address adverse effects on caribou migration, including corralling effects, and lessees must complete additional studies. Activities must be suspended May 20-August 20 in this area, and traffic restrictions (speed under 15 MPH when caribou are within ½ mile of the road and traffic must be stopped when 10 or more caribou are attempting road crossings). A vehicle use plan is required (Lease Sale and BMP K-11).
 - Roads are prohibited in the Pik Dunes (BMP K-8), the Teshekpuk Lake Caribou Movement Corridor (BMP K-9), and the Southern Caribou Calving Area (BMP K-10).

4.4.4.2 State of Alaska Measures to Address Road Impacts

In the Best Interest Findings for the 2008 North Slope and the 2009 Beaufort Sea Areawide Oil and Gas Lease Sales, ADNRC includes a number of mitigation measures related to roads.⁴⁷ Many of these measures allow departure from the requirement if there are no practicable alternatives.

- **Siting Restrictions:**

- Mitigation Measure 1.c gives an exemption for pipelines and roads to a 500-foot setback from fish-bearing water bodies. It also requires that road, utility, and pipeline crossings be consolidated and aligned perpendicular or near perpendicular to watercourses.
 - Facilities are prohibited within 500' of fish-bearing waters, 1,500 feet from all current surface water drinking sources, and ½ mile from banks of specified rivers (Mitigation Measure 1c).
 - No facilities will be sited within ½ mile of identified Dolly Varden overwintering and/or spawning areas on the Canning, Shaviovik, and Kavik rivers unless the crossing is not within an overwintering area or the road or pipeline crossing will have no significant adverse impact to the habitat (North Slope Areawide Mitigation Measure 1d).
 - Bridges may be required for crossing fish spawning and important rearing habitats. Culverts or other stream crossing structures must provide free and efficient passage of fish. Seasonal restrictions may be imposed on travel through important caribou or other large ungulate calving and overwintering areas. Lessees are encouraged to plan and design activities with consideration of the final report to the Alaska Caribou Steering Committee (Cronin et al., 1994) (Lessee Advisory-1).
- **Exploration:** Roads and pads, must be temporary and be constructed of ice. Vehicle refueling shall not occur within the annual floodplain, unless approved in the plan of operations (Mitigation Measure 1e).
 - **Studies:** Prior to placement of roads, an inventory of prehistoric, historic and archeological sites must be completed that includes considering information provided by the nearby communities (Mitigation Measure 6).

⁴⁷: Unless otherwise noted, the stipulations refer to both the North Slope and Beaufort Sea areawide lease sale best interest findings.

4.4.4.3 NSB Measures to Address Road Impacts

Title 19: The NSB includes various requirements for roads and road related activities in the Title 19 zoning code and in standard stipulations placed on permits.⁴⁸

- **Transportation Corridor:** A linear Transportation Corridor district is included in Title 19 for pipelines and roads NSBMC § 19.49.090. A number of requirements are specified for the Dalton Highway corridor (NSBMC § 19.70.060).
- **Areas of Avoidance:** Vehicles likely to cause significant disturbance must avoid areas where species that are sensitive to noise or movement are concentrated. Horizontal or vertical buffers will be required where appropriate (NSBMC § 19.70.030).
- **Wildlife Access:** A means for unimpeded wildlife crossing shall be included in the construction of roads and pipelines in areas used by wildlife (NSBMC § 19.70.030(L)(5)).
- **Prohibitions:** Certain activities are prohibited unless they meet specified criteria: Projects that will significantly obstruct wildlife, projects with duplicative corridors (NSBMC § 19.70.030(J)(3)), unconsolidated transportation facilities and utilities (NSBMC § 19.70.030(K)(6)).
- **Water Courses:** Transportation and utility facilities, including ice roads, must minimize alteration of shorelines, water courses, wetlands, tidal marshes, and significant disturbance to important overwintering areas for fish (NSBMC § 19.70.030(L)(2)).

Standard Stipulations:

- **Plan:** General Stipulation 1 requires preparation of and compliance with a transportation plan.
- **Permafrost and Drainage:** General Onshore Stipulation 2 requires maintenance of natural permafrost insulation and maintenance of drainage. Onshore Oil and Gas Pipeline Stipulation 4 requires adequate culverting to ensure natural drainage patterns.
- **Shoreline Alteration:** General Onshore Stipulation 3 requires minimization of alteration of shorelines, water bodies and wetlands. It also requires minimization of road runoff.
- **Design:** Nine Gravel Road and Airstrip Stipulations require approval of landowner, compact design and sharing of facilities, maintaining of permafrost, and gravel extraction measures.

Coastal Management Enforceable Policies:

- **Location Restrictions:** Policy C-4 required setbacks from anadromous waters (500 feet), headwater streams (250 feet) and other water bodies (100 feet) unless the

⁴⁸: Title 19 requirements specific to Barrow are not included.

applicant demonstrates there will be no significant effect and there is a need for the facility. Specific Animal Stipulation 7 prohibits location of gravel pads, roads, airstrips, and pipelines within one mile of important caribou insect relief habitat. On a case-by case basis, and in consultation with government agencies, essential pipeline and road crossings may be permitted through these areas where no other options are available.

- **Caribou Calving Area:** Policy C-8 requires certain protections for activities in caribou calving areas, including consideration of the use of convoys.
- **Non-duplication:** Policy H-1 required use of existing corridors when possible.

4.4.5 Conclusions Related to Roads

Roads meet the needs of North Slope residents for travel within villages, access to local subsistence resources and as a means to lower transportation costs. Roads also support the oil and gas industry which in turn provides a tax base for the state and federal governments as well as the NSB. For the most part, lease and permit stipulations adequately avoid or minimize road impacts to residents, wildlife and habitat.

Local access to current and new roads is an ongoing concern for local residents. One company has proposed including turnouts in a new road through NPR-A to accommodate local subsistence users. More work is needed to ensure locals benefit from increased access while not conflicting with industrial use.

While new road connections between villages or to the Dalton Highway are supported by some residents, they are opposed by others. Concerns range from potential competition for subsistence resources from outsiders to increased social ills associated with more access to drugs and alcohol. Roads also increase demand for the limited resources allocated for public safety and search and rescue. Planning for new roads merits further attention by the NSB and state and federal agencies to ensure effective local involvement occurs.

While roads do impact caribou to some degree, the population of the Central Arctic Herd has increased during the years of North Slope development. This increase may be a result of natural population cycles as well as from efforts to mitigate impacts. The following bullets summarize some of the measures implemented by agencies and industry to reduce impacts of roads on caribou.

- New roads and pipelines are separated by at least 500 feet. This practice minimizes visual barriers and reduces snow drifts.
- Newer oil fields employ technologies that have reduced the footprint for facilities, including roads, and agencies have encouraged joint use of roads and other facilities.
- Existing traffic restrictions for oil field roads have limited the number of caribou injuries and deaths.
- Adequate drainage structures have reduced habitat flooding.

Researchers have found that additional mitigation of some of the impacts that roads have on habitat will not likely provide measurable benefits. Measures that may not be needed include those related to reducing impacts to forage quality or quantity, burial of vegetation by road dust, and reduction in the amount of feeding time by caribou (Cronin et al. 1994).

A more complete understanding of the impacts of roads can be improved by focusing future studies. Baseline studies in new areas of exploration and development, such as the NPR-A, will provide a frame of reference to measure future impacts. A lack of pre-development data for current oil fields makes it difficult for researchers to make firm conclusions. Researchers have recommended that future studies place more emphasis on cumulative impacts to caribou (Wolfe et al. 2000). Natural variation in caribou behavior and migration, however, make it difficult to understand cumulative impacts.

Cumulative impacts of transportation corridors, including potential new roads constructed in association with NPR-A developments or the transport of offshore resources, are also a concern. Future studies on winter crossings of roads will be important for the Teshekpuk Herd because they winter in potential areas of development.⁴⁹ In addition, future studies need to provide more information about potential impacts to caribou on the population rather than impacts to individual caribou.

Section 5.4 includes recommendations related to existing and new road corridors on the North Slope.

4.5 Pipelines

This section focuses on how the Borough strives to balance the need for pipelines to facilitate economic growth with the need to minimize impacts to users and subsistence resources, particularly caribou.



Caribou crossing an infield road at Badami
(Photo: GSavant Alaska LLC)

4.5.1 Overview of Issues Related to Pipelines

Pipelines provide a critical component of the industrial infrastructure that is necessary to facilitate the production and transport of crude oil, the economic life blood of the Borough. Like

⁴⁹: There is currently no development allowed in the Teshekpuk Lake Special Area where a majority of the Teshekpuk Herd winters.

roads, pipelines are linear structures that can impact fish and wildlife and subsistence access as summarized in the following bullets.

- **Caribou Crossings:** Some residents have expressed concerns about impacts to caribou from new pipelines across NPR-A. Pipelines can inhibit caribou movement, especially those constructed with less than a five-foot clearance and those located within 500 feet of roads are known to impact caribou crossings.
- **Snow Drifts:** Snow drifting has the potential to impact caribou in the NPR-A. Unlike the Central Arctic Herd, the Teshekpuk Caribou Herd overwinters on the North Slope, and they have not been accustomed to pipelines. In addition, the Western Arctic Herd, which spends summers on the North Slope, has been declining four to six percent a year since the population peaked in 2003. Pipelines can also provide a barrier to subsistence travel from drifting.
- **Corralling:** There have also been concerns that prohibitions on construction of pipelines in some areas of NPR-A could lead to corralling of caribou in areas open to pipelines, thereby affecting movements to insect relief areas.
- **River Crossings:** Pipeline crossings have the potential to impact fish habitat through leaks and spills, siltation, and bank erosion.
- **Thaw:** Thawing of permafrost poses threats to the stability and safety of elevated pipelines.
- **Visual Disturbance:** Visual impacts may occur to subsistence users and caribou from the reflectivity of the pipelines.

Many of the issues described in this section have been avoided or minimized as discussed in Section 4.5.3.

4.5.2 Background

Pipelines of various utility are required to produce the oil and gas that is the financial cornerstone of the NSB. Without pipelines, there would be no oil and gas related income generated for the Borough. Pipelines fall into two categories on the North Slope, based on the types of fluids they transport: 1) Three-phase pipelines, and 2) Single-phase pipelines.

Three-phase pipelines transport oil, gas and water from drill sites to process facilities for separation and either sales or reuse in the production process. Three-phase pipelines, also commonly referred to as flowlines, make up the bulk of the pipelines on the North Slope.

Single-phase pipelines are fit-for-purpose pipelines. They are used to transport water from seawater treatment plants and separation facilities to drill sites for injection into the formation

to enhance oil recovery. They are also used to transport gas to drill sites to assist in lifting wellbore fluids to the surface and for reinjection back into the reservoir for pressure support and enhanced oil recovery. Lastly, single-phase pipelines are used for sales oil transport, typically in the form of common carrier, regulated pipelines.

Pipelines can also be characterized by type of construction, and fall into the following categories:

- Elevated pipelines,
- Buried pipelines, and
- Offshore (subsea) pipelines.

Each type of pipeline construction has unique benefits that are useful in mitigating potential impacts of development.

Elevated Pipelines: Elevated pipelines are the most common onshore pipelines on the North Slope because they can be readily constructed during the winter, minimize the amount of disturbance to the tundra, avoid subsidence issues attributed to heat loss that thaws permafrost soils, and can be visually monitored for corrosion and leaks. Elevated pipelines require frequently spaced vertical support members (VSMs) to hold them in place.

Elevated pipelines are required to be designed to allow the free movement of caribou and the safe, unimpeded passage of the public while participating in subsistence activities. Agencies generally require that pipelines be elevated at least seven feet above the ground and be spaced at least 500 feet from a road. When appropriate, companies may choose to bury pipelines (NPR-A 2013). With the exception of TAPS, about half of which is buried, almost all onshore pipelines on the North Slope are elevated. Other minor exceptions include portions of pipelines that are bored under rivers, or buried to facilitate road and caribou crossings.

Buried Pipelines: The advantage of buried pipelines is that they do not interfere with caribou movement or subsistence activities. Like elevated pipelines, they can be constructed during the winter season. The advantages are challenged, however, by the fact that it is impossible to visually monitor buried pipelines for corrosion or for leaks. Also, pipelines buried in or near permafrost require subsidence design considerations that could be cost prohibitive. Lastly, pipelines buried in the tundra leave scars visible in the tundra for decades. Burying pipelines in roads, in certain instances (e.g., cold oil transport), may prove to be an acceptable mitigation technique if proper corrosion, leak detection and permafrost stability technologies are implemented.

Offshore Subsea Pipelines:⁵⁰ Subsea pipelines are expected to be the most likely option for bringing oil to shore-based processing facilities. The Northstar Project in the Beaufort Sea, the

⁵⁰: Information for this section was primarily obtained from the Beaufort Sea Areawide Oil and Gas Lease Sale, Final Finding of the Director, November 9, 2009 (Alaska Department of Natural Resources 2009).

Arctic's first subsea pipeline, brings oil from an artificial gravel island six miles offshore to an elevated onshore pipeline. The Ooguruk development, also in the Beaufort Sea, uses a subsea pipeline to carry oil, gas and water from a gravel island five miles offshore. These pipelines have been buried so they will not hinder water circulation and have no significant impacts to fish, wildlife and navigation. In deeper waters, pipelines can be placed on the bottom of the seabed and will become naturally buried.

For the current subsea pipelines in the Beaufort Sea, the shortest distance has been chosen to bring them to shore. In order to prevent damage to the permafrost transition areas at the landfall locations, pipelines can be buried in or located on short causeways, placed in directionally drilled tunnels, or placed in insulated pipes in gravel-filled trenches (the preferred method based on current technology).

Ice forces require special engineering to prevent damage from strudel scouring or ice gouging. Strudel scouring can occur offshore where water from rivers can drain through cracks and create a whirlpool effect that scours the sea floor. Ice gouging occurs offshore when floating ice, driven by winds or waves, scrapes along the seafloor.

Although earthquakes in the NSB are rare, subsea pipelines in the Beaufort Sea are designed to withstand this hazard. This requirement will likely extend to future development in the Chukchi Sea.

There are three subsea pipelines operating in the Arctic Ocean: Northstar, Ooguruk and Nikaitchuq, and all have been successfully constructed and operated using current technology. The unique conditions present in the Arctic have presented challenges, and those challenges have been met by engineering solutions. Where there is an artificial island contemplated for oil and gas development in the waters off the Alaska coast, additional subsea pipelines will be required.

4.5.2.1 Potential New Pipelines in or near the NPR-A

Each of the new projects identified in Table 3-7 (Schedule of New Development Projects: Ten-Year Forecast) will require various types, sizes and lengths of new pipelines. ConocoPhillips is well into the permitting stage of both the Alpine West (CD-5) and the Greater Mooses Tooth GMT-1 projects, with GMT-2, the recent Bear Tooth Unit and Fiord-West projects in the development appraisal stage.

With multiple discoveries recently announced in the fairway between the Kuparuk and Colville River units, it is conceivable that a series of north-south pipeline spurs will be required to connect to the existing Alpine pipeline. Additionally, if Linc Energy proceeds with developing the Umiat field, either an approximate 100-mile pipeline running east to the Dalton highway, or an approximately 80-mile pipeline running north to existing infrastructure at the Kuparuk River Unit will be constructed.

If commercial discoveries are made in the Chukchi Sea, a lengthy cross-country oil sales pipeline will likely be constructed. Such a pipeline would bisect the NPR-A and terminate at a connection to TAPS somewhere either within the existing pipeline infrastructure or along the TAPS right-of-way.

4.5.3 Mitigation of Pipeline-Related Impacts

The primary concern regarding constructing pipelines across the North Slope landscape is interference with caribou migration and subsistence hunting. Pursuant to the NSBMC, agencies have developed and incorporated science-based measures to mitigate potential adverse effects of oil and gas development.

4.5.3.1 Scientific Basis for Mitigation

In a comprehensive literature review Lawhead et al. (2006) synthesized the following with respect to the effects of elevated pipelines on the movements of caribou, as well as impacts to subsistence users.

1. Pipelines can act as obstructions that impede caribou movements but do not act as complete barriers unless they are physically impassable, such as large-diameter pipelines on or near the ground.
2. Pipelines elevated to a minimum height of five feet above ground accommodate caribou crossings during snow-free periods.
3. During winter, limited data indicate that caribou are more likely to cross under pipelines if the minimum height is seven to eight feet above ground. This allows for snow to accumulate under the pipelines.
4. When pipelines that are elevated five feet above the ground are located near (less than 400-500 feet) high-traffic roads (15 or more vehicles per hour), the synergistic effect reduces caribou crossing success. The literature is silent on crossing success in the scenario of a pipeline elevated seven feet above ground but located closer than 400-500 feet from high-traffic roads.
5. Other factors that confound the evaluation of pipeline-crossing success by caribou include differences in infrastructure and study design, caribou group dynamics, insect harassment, season, habitat, topography, habituation, and the effects of pipeline sheathing reflectivity.
6. Pipelines that are high enough to accommodate caribou crossing in winter should also be high enough to safely accommodate snow machines.

Lawhead et al. (2006) also recommended five areas for future study regarding pipeline height: 1) Adequacy of 1.5 meter high pipeline in winter,⁵¹ 2) Effects of habituation, 3) Reflectivity of pipeline sheathing,⁵² 4) Other factors (e.g., effects of visual stimuli and noise), and 5) Adequacy of pipeline height for subsistence users.

51: All cross-country pipelines constructed since 2006 have been elevated at least seven feet above ground.

52: The Point Thomson Master Plan prepared by ExxonMobil commits to use of an external coating on the export pipeline that will reduce glare and contrast.

4.5.3.2 Mitigation of Pipeline Impacts by BLM

The BLM included a number of measures in its 2013 ROD for the NPR-A IAP/EIS. A provision allows for departure from these restrictions if approved by the BLM authorized officer.

- **Information:** GIS shape files must be provided for pipelines (BMP E-15).
- **Avoidance or Minimization of Impacts:**
 - Unless determined to be essential after consultation with the NSB and others, pipelines are prohibited in certain streambeds and adjacent rivers, (Lease Stipulation/BMP-K1) and on the lake or lakebed or within one-fourth mile of the high water mark (Lease Stipulation/BMP-K2).
 - Prior to permitting pipelines in the Goose Molting Area, a workshop will be convened with the NSB and others to determine the best corridor. Specific criteria must be met, including screening June 15-August 15 (e.g., orientation or temporary fences) from activities, temporary fences during molting, and limiting ground traffic June 15-August 20 (convoys, vehicle types, etc.). Monitoring studies will be developed by the BLM after conferring with the NSB and others (BMP-K4A).
- **Prohibitions on Siting within Special Areas:**
 - Within the Teshekpuk Lake Caribou Habitat Area, linear corridors will be oriented to address migration and corralling effects and to avoid loops of pipelines that connect facilities. Ramps over pipelines, buried pipelines, or pipelines buried under the roads may be required after consultation with the NSB and others. Construction activities will be suspended May 20–August 20. Ground restrictions are imposed during specific times of the year (BMP K-5).
 - Only perpendicular pipelines may be permitted in the Pik Dunes (BMP K-8).
 - A workshop will be convened with NSB and others for pipelines proposed in the Teshekpuk Lake Caribou Movement Corridor (BMP K-9) and in the Southern Caribou Calving Area (BMP K-10).
- **Siting and Construction:** Pipelines shall allow free passage of caribou and safe, unimpeded passage of subsistence users. A minimum distance of 500' must be kept between roads and pipelines, or where not feasible, pipelines may be buried under roads. A minimum height of seven feet from ground to bottom of pipeline at VSMs is required. In areas where terrain may funnel caribou, ramps over pipelines, buried pipelines or pipelines buried under roads may be required (BMP E-7).
- **Plans:** An approved quality assurance/quality control plan is required for preventing corrosion and mechanical defects (BMP E-4).

4.5.3.3 Mitigation of Pipeline Impacts by State of Alaska

The Best Interest Findings for the 2008 North Slope and the 2009 Beaufort Sea areawide oil and gas lease sales include a number of mitigation measures related to pipelines.⁵³ Many of these measures allow departure from the requirement if there are no practicable alternatives.

- **Siting and Construction Restrictions:**

- Mitigation Measure 1.c gives an exemption for pipelines and roads to a 500-foot setback from fish-bearing water bodies. It also requires that road, utility, and pipeline crossings be consolidated and aligned perpendicular or near perpendicular to watercourses.
- No facilities will be sited within 1/2 mile of identified Dolly Varden overwintering and/or spawning areas on the Canning, Shaviovik, and Kavik rivers unless the crossing is not within an overwintering area or the road or pipeline crossing will have no significant adverse impact to the habitat (North Slope Areawide Mitigation Measure 1d).
- North Slope Areawide Mitigation Measure 1.g (Beaufort Sea Areawide Mitigation Measure 1.f) requires pipelines to: use existing transportation corridors where conditions permit, be designed for the containment and cleanup of spilled fluid, and be located on the upslope side of roadways.
- Beaufort Sea Areawide lease sale measures include several additional requirements. Mitigation Measure 1.h requires that all pipelines be designed and constructed to withstand ice and other natural hazards, including permafrost thawing. Mitigation Measure 1.i encourages the use of offshore pipelines if technically feasible and environmentally preferable to transport by oil tanker or other means. Mitigation Measure 1.j prohibits transport of crude oil by vessel once a pipeline of sufficient capacity is operable.

- **Caribou:**

- Pipelines shall be designed and constructed to avoid significant alteration of caribou and other large ungulate movement and migration patterns. Pipelines shall be elevated seven feet measured from the ground to the bottom of the pipe, except where the pipeline intersects a road, pad, or a ramp installed to facilitate wildlife passage. Snow depth in relation to pipe elevation shall be considered to ensure adequate clearance for wildlife (Mitigation Measure 1h).
- Lessees are encouraged to plan and design activities with consideration of

⁵³: Unless otherwise noted, the stipulations refer to both the North Slope and Beaufort Sea areawide lease sale best interest findings.

findings in the final report to the Alaska Caribou Steering Committee (Cronin et al., 1994) (Lessee Advisory-1).

- **Studies:** Prior to placement of roads, an inventory of prehistoric, historic and archeological sites must be completed that includes consideration of information provided by the nearby communities (Mitigation Measure 6).

4.5.3.4 Mitigation of Pipeline Impacts by NSB

Title 19: The NSB includes various requirements for roads and road related activities in the Title 19 zoning code and in standard stipulations placed on permits.⁵⁴

- **Transportation Corridor:** A linear Transportation Corridor district is included in Title 19 for pipelines and roads (NSBMC § 19.49.090).
- **Wildlife Access:** A means for unimpeded wildlife crossing shall be included in the construction of roads and pipelines in areas used by wildlife. Aboveground pipelines must be elevated a minimum of five feet from the ground to the bottom of the pipe except those areas where the pipeline intersects a road, pad or caribou ramp, or areas within 100 feet of a pipeline that is elevated less than five feet. Best available information will be evaluated during project review to determine pipeline burial, ramping, and elevation (NSBMC § 19.70.030(L)(5)).
- **Prohibitions:** Certain activities are prohibited unless they meet specified criteria: Projects that will significantly obstruct wildlife, projects with duplicative corridors (NSBMC § 19.70.030(J)(3)), unconsolidated transportation facilities and utilities (NSBMC § 19.70.030(K)(6)).
- **Water Courses:** Transportation and utility facilities, including ice roads, must minimize alteration of shorelines, water courses, wetlands, tidal marshes, and significant disturbance to important overwintering areas for fish (NSBMC § 19.70.030(L)(2)).

Standard Stipulations: Standard stipulations placed on permits address a number of pipeline requirements.

- **Spill Prevention:** Spill Prevention and Response Stipulation 2 requires an oil spill prevention and response plan that includes pipeline leak detection, corrosion control, a training program, and a plan to protect sensitive areas. Oil Spill Contingency Mitigation Agreement Stipulation 1 requires permittees to sign an Oil Spill Contingency Mitigation Agreement with the NSB and possibly the Inupiat Community of the Arctic Slope (ICAS) and the Alaska Eskimo Whaling Commission (AEWC) prior to operation.
- **Design and Construction:** General Onshore Stipulation 2 requires that the natural permafrost insulation quality of existing soils and vegetation be maintained.

⁵⁴: Title 19 requirements specific to Barrow are not included.

- **Wildlife:** Three Onshore Oil and Gas Pipeline stipulations require design for unimpeded wildlife crossings, including a seven foot elevation at VSMs, ramping or burial. Pipelines must also be separated 500 feet from roads. Flowlines must be within 1,000 feet from access roads unless otherwise approved by the NSB. The stipulations also require consolidation of pipelines to the maximum extent possible. Specific Animal Stipulation 7 prohibits location of gravel pads, roads, airstrips, and pipelines within one mile of important caribou insect relief habitat. On a case-by case basis, and in consultation with government agencies, essential pipeline and road crossings may be permitted through these areas where no other options are available. Specific Animal Stipulation 8 requires ramps over pipelines, buried pipes in caribou calving areas.
- **Hazards:** Offshore General Stipulation 3 requires pipelines to withstand sea waves, ice gouging and override and erosion.

Coastal Management Enforceable Policies: A number of enforceable policies from the 2007 draft NSB Coastal Management Plan address pipelines.

- Policy C-4 required setbacks from anadromous waters (500 feet), headwater streams (250 feet) and other water bodies (100 feet) unless the applicant demonstrates there will be no significant effect and there is a need for the facility.
- Policy H-1 required alignment of east-west pipelines along the coast and inland (if pipelines would corral caribou), construction of above ground pipelines in thaw bulbs, siting of pipelines at least 500 feet from roads, use of materials to make pipelines cannot withstand a 338 caliber rifle, and construction of pipelines above feet.
- Policy H-2 prohibited unnecessary water crossings. Where crossings are necessary, they should be consolidated, use elevated structures.
- Policy A-5 required measures be included in the project description that demonstrated that pipelines and other facilities blend in with the surrounding landscape, including use of appropriate colors, non-reflective surfaces, shapes that mimic the surrounding environment, or screening of facilities.

4.5.4 Conclusions Related to Pipelines

Over the past 20 years, government agencies have worked with the oil industry to improve pipeline siting and design criteria that encourage new oilfield development while effectively mitigating concerns regarding the impacts on wildlife and subsistence activities. These criteria include setbacks from certain rivers and fish-bearing waters, prohibition on locating pipelines in sensitive areas, a minimum seven-foot height for new pipelines, and a 500-foot separation from roads. Other measures include completion of studies for pipelines proposed in certain areas and consultation requirements with the NSB and others. In addition, some companies

have addressed concerns of NSB residents about the reflectivity of pipelines by applying non-reflective coatings to pipeline. The mitigation measures for pipelines have greatly reduced impacts, especially with regard to obstructions to caribou movement that resulted from early pipelines constructed on the North Slope.

As plans to extend the pipeline network further, some residents have expressed concerns about potential corralling of caribou and impacts to caribou calving and migration. Development of gas reserves at Point Thomson and potential development of offshore oil and gas resources in the Chukchi Sea could result in a pipeline network from Wainwright to Pt. Thomson. Potential impacts of an expanded pipeline network will require increased communication with local residents and incorporation of local and traditional knowledge when selecting final routes and design criteria.

Potential solutions to concerns about corralling caribou from an expanding pipeline network include burying of pipelines. Burying pipelines in roadbeds is a potential mitigation technique that could reduce concerns about impacts to caribou movement. Burying pipeline offshore along areas of sensitive onshore areas may also be an alternative that would reduce impacts to caribou movement. Also, additional research may be needed to fill gaps in knowledge about the impacts of pipelines on caribou crossings during the winter, impacts from pipeline reflectivity, and impacts on subsistence users during the winter. Securing adequate baseline data for the NPR-A will provide a basis to compare future impacts; this kind of comparison is not available for the Prudhoe Bay area due to the lack of pre-development baseline data.

Another need for future work relates to the success of requirements to collocate new pipelines with existing pipeline corridors. While there are existing requirements to do so, there is some indication that there could be better consolidation of pipelines.

Section 5.5 provides recommendations to address outstanding issues related to pipeline location and design.

4.6 Gravel Islands

Gravel islands have been successfully used in the Beaufort Sea for decades and continue to offer a viable alternative to constructing bottom-founded platforms for long-term oil and gas development in state and federal waters off the coast of Alaska. Gravel islands constructed on ice have also proven effective as temporary floating exploration pads. Between 1975 and 2013, 19 gravel islands were constructed in the Beaufort Sea for both exploration and production purposes. One additional island, Spy Island, was constructed in 2010 by Eni Petroleum for use as a drilling site for the Nikaitchuq field development. It is located inside the natural barrier island with the same name, about four miles north of Oliktok Point.

All of the gravel islands currently being used for oil and gas development are manmade and

are located in state waters within the Beaufort Sea. See Section 3.2.2.7 (Table 3-6) for a list of specifications for islands currently being used for oil and gas development. Figure 3-15 shows the location of gravel islands currently being used for production in the Beaufort Sea.

4.6.1 Background Related to Gravel Islands

Once an offshore or nearshore hydrocarbon accumulation has been adequately defined and delineated, the decision to construct a gravel island for long-term oil and gas production activities may be influenced by the following six factors.

1. The proximity to the reservoir being evaluated for development⁵⁵
2. The proximity to existing facility and pipeline infrastructure
3. Bathymetry
4. Environmental issues (e.g., seafloor disturbance, marine mammal activity and fish migration)
5. The availability and cost of gravel
6. Land use restrictions⁵⁶

Artificial islands have been built either during the winter by trucking gravel fill over the ice or in the summer using dredges using local subsea materials. Islands have been constructed of gravel, sand, silt and a mixture thereof. Slope protection has been designed to match the measured and predicted sea and ice conditions, which also influence the island freeboard needed to avoid wave over-topping. Slope protection methods for artificial islands have included anchored poly-filter cloth and sandbags, articulated concrete blocks, rock fill, and sacrificial beaches. Artificial island designs have to account for constructional constraints, working area needed, ice action, wave action, and geotechnical factors (U.S. Army Corps of Engineers 2008).

The deepest granular fill island was Issugruk O-61, constructed in the Canadian Beaufort in 1980 in 62 feet of water. The island took three seasons to complete and required 6.5 million yards of gravel. The U.S. Army Corps of Engineers completed a comprehensive technological assessment of the use of gravel islands for oil and gas exploration and development titled *Arctic Offshore Technology Assessment of Exploration and Production Options for Cold Regions of the US Outer Continental Shelf* (U.S. Army Corps of Engineers 2008).

Current areas of known or prospective hydrocarbon accumulations that may benefit from

55: Advances in directional drilling technology allow for horizontal drilling departures of up to 35,000 feet from the surface location (Wytch Farm, Sakhalin). Drilling departure may be limited by the depth of the reservoir and the complexity of the well design.

56: Land use restrictions in high oil and gas potential areas in ANWR and in the NPR-A Special Areas currently preclude new non-subsistence infrastructure or exploratory drilling.

artificial island construction include Liberty,⁵⁷ Qugruk Unit, Northwest Milne Point, Smith Bay, Western Harrison Bay, Eastern Harrison Bay (Nikaitchuq), Beechey Point, Flaxman Island, Sivulliq, and Kuvlum.

Artificial island construction requires large volumes of gravel. Assuming island geometry resembles a truncated square pyramid with side slopes consistent with North Slope road construction (2 to 1 slope ratio), a ten-acre island requires approximately 15,000 yards of gravel for every foot above the sea-floor.⁵⁸ Most gravel islands constructed for oil and gas production are designed with 5-10 feet of island freeboard.

4.6.2 Overview of Issues Related to Gravel Islands

Gravel islands have provided an alternative to bottom founded offshore structures in the Arctic for many years. They may also prove useful in the future to facilitate safe and efficient development of oil and gas reserves that are located near shore and in areas where there are environmentally sensitive areas onshore. Gravel island construction and use could impact water quality, near shore circulation patterns, marine life, and subsistence whaling. Other concerns about artificial gravel islands include impacts of noise from construction and drilling, ability to withstand ice forces and erosion, and bird mortality due to collisions with on-island structures. It is the goal of the Borough to promote responsible oil and gas development while avoiding or mitigating adverse impacts, and accordingly, many of the issues relating to gravel island construction and use have been avoided or minimized as discussed in the next section.

4.6.3 Mitigation of Impacts Related to Gravel Islands

BLM, ADNR and the NSB have developed a limited number of mitigation measures for artificial gravel islands. Federal, state and local requirements are discussed in the following bullets rather than in separate sections.

- **ADNR Mitigation Measures:** Artificial gravel islands and bottom founded structures shall not be located in river mouths or active stream channels on river deltas. Each proposed structure will be reviewed by DNR in consultation with other state resource agencies and the NSB to determine that the structures are necessary for field development and no practicable alternatives exist. A monitoring program may be required to address water quality, free passage of fish, and mitigation (North Slope Areawide Mitigation Measure 1h and Beaufort Sea Mitigation Measure 1.k).⁵⁹

57: BP recently proposed to BOEM a stand-alone drilling and production processing island as the safest and most environmentally responsible scope of development for the Liberty project in federal waters in the Beaufort Sea. Construction could begin by 2017.

58: The volume of a truncated square pyramid is equal to one-third of the height multiplied by the sum of the areas of the top base, the bottom base and the square root of the difference between the areas of the top and bottom bases.

59: The Beaufort Sea measure prohibits continuous fill causeways while the North Slope measure discourages them.

- **BLM Mitigation Measures:**

- Artificial gravel islands are prohibited in river mouths or active stream channels on river deltas. Artificial islands shall be designed for the free passage of marine and anadromous fish, and prevent nearshore circulation patterns. A monitoring program is required for water quality and free passage of fish (Lease Stipulation E-3).
- For specified bays, inlets, lagoons, and rivers, no permanent facilities are allowed under the water within three-quarters mile seaward of shoreline. Elsewhere, permanent facilities within the major coastal waterbodies will be allowed on or under the water only if they meet specific criteria (BMP K-3).
- Exploratory well drill pads, production pads or a central processing unit are not allowed in the coastal waters or on islands between the northern boundary of NPR-A and the mainland or within one mile of the coast (Lease Stipulation K-6).

- **NSB Standard Stipulations:**⁶⁰

- Offshore General Stipulation 4 requires that offshore structures be able to withstand geophysical hazards.
- The Causeway Stipulation requires designs to allow free passage of fish.

4.6.4 Conclusions Related to Gravel Islands

Industry has experience constructing gravel islands in the Beaufort Sea for 40 years.⁶¹ Most impacts of gravel islands and causeways are avoided or minimized due to measures required by agencies or proposed by operators. In addition, advances in extended reach drilling provide opportunities to develop some offshore fields without constructing artificial islands.

In areas where there are highly sensitive onshore habitats, artificial island construction may offer a way to implement the NSB ordinance that requires “identifying and securing, for present and future residents the beneficial impacts of development, while avoiding and mitigating any negative impacts” (NSBMC § 19.10.020). Onshore hydrocarbon resources that are within three or four miles of the coast can be developed using extended reach drilling from an offshore site without infringing on caribou calving or insect relief areas. Likewise, critical waterfowl habitat can also be avoided. The use of gravel islands may be especially applicable in areas like Smith Bay and Harrison Bay where there is a known presence of hydrocarbons

60: None of the proposed 2007 proposed enforceable policies directly addressed gravel islands or causeways.

61: The first offshore artificial gravel drilling island in the Beaufort Sea was constructed in 1972 in Canadian waters by Imperial Oil (IMVPA 2008).

within designated onshore special areas where non-subsistence activities are currently prohibited.

Since gravel island construction requires significant volumes of gravel, potential areas for additional research include alternative gravel sources, particularly ocean-based sources. Sourcing gravel using seafloor dredging in areas where there are not sensitive benthic biological resources would minimize the number of new onshore gravel mine sites and reduce dust and traffic concerns related to hauling millions of yards of gravel. Section 5.6 addresses recommended actions regarding gravel islands.

4.7 Air Traffic

Like roads and pipelines, air traffic within the Borough is somewhat of a two-edged sword. Residents of the Borough depend heavily on air service for the delivery of goods and services as well as a means to travel between communities both inside and outside of the region. Visitors to the Borough, including seasonal recreationalists and researchers, also rely heavily on air travel. Oil and gas exploration and development, the economic engine of the Borough, depends on air traffic to ferry thousands of workers to job sites both remote and in the more industrially developed areas. All of these air traffic uses can impact both subsistence resources as well as subsistence users.

The Federal Aviation Administration (FAA) is responsible for regulating air traffic in the Borough, although other federal and state agencies and the Borough also require certain measures associated with horizontal and vertical buffers and seasonal restrictions.

This section identifies major issues relating to air traffic and current measures by federal, state and local agencies to mitigate the adverse impacts of air traffic on NSB residents. The Borough and other entities also require various measures regarding airstrip construction, but those are not addressed in this report unless they relate to siting of airstrips to avoid impacts to wildlife. Chapter 5 provides recommendations for addressing air-traffic related issues.

4.7.1 Overview of Issues Related to Air Traffic

Although other issues exist, the overwhelming concern regarding air traffic within the NPR-A (and the Borough in general) is the impact of aircraft on wildlife and subsistence users. While local residents undoubtedly appreciate the ability to use air travel to facilitate non-subsistence related travel, air traffic interference that significantly impacts food harvest is intolerable, regardless of the source.

At public meetings and hearings, residents often report impacts to wildlife and subsistence activities from air traffic. For example, they report that the noise from frequent air traffic diverts caribou and in some cases makes it impossible to harvest the caribou. Animals are especially

vulnerable during certain times of the year, such as caribou calving, marine mammal haul outs, and bird molting periods. In addition, certain places may be more sensitive than others, especially where large numbers of animals congregate.

Oil and gas development is not the only source of concern for residents with respect to air traffic. Residents have expressed concern about air traffic related to guides and transporters as well as impacts from research. Regarding research, duck and geese hunters have reported that summer research has hindered their subsistence activities. In addition, there have been reports of harassment of wildlife when planes fly low over wildlife in an effort to give clients a closer look.

Various measures have been adopted at the federal, state and local level to reduce the impacts of air traffic within the Borough. These measures are discussed in Section 4.7.3.

4.7.2 Background

Information regarding the amount of air traffic within the NPR-A is sparse due to limited requirements to collect such data. The three major types of aircraft operating in the Borough include jets, propeller-driven planes and helicopters.⁶² These aircraft are used for commercial, industrial, recreational, scientific, search and rescue, medical evacuations, and national defense purposes.

Commercial flights include the large planes that bring freight and passengers to Barrow and Deadhorse. Small carriers transport travelers and cargo to and from the villages.

Industrial flights in the NSB are typically associated with transporting workers and cargo associated with oil and gas resource exploration, development and operation. Prior to exploration drilling, aircraft may be used to conduct seismic surveys, cultural resource surveys, habitat assessments, other baseline environmental studies, as well as route selection ice roads and well staking. When access by on-ground tundra travel is not feasible, these activities involve the use of aircraft to transport personnel and supplies to otherwise inaccessible locations in preparation for drilling. Once a discovery is deemed commercial to develop, the construction phase of the project is a multi-year, personnel-intensive undertaking with significant air traffic requirements. Post construction, air traffic intensity subsides to more of a support level associated with development drilling and facility maintenance and continuing throughout much of the life of the field, diminishing as field depletion matures. Although no field on the North Slope has ever been abandoned, inevitable field abandonment will result in a final multi-year surge of air traffic activity as the labor force increases substantially.

Recreational air traffic is usually seasonal, when mostly non-resident users access remote

⁶²: In 2013, ConocoPhillips used unmanned aerial vehicles (drones) for offshore surveillance purposes. This new technology has a potential for both positive and negative effects.

areas by transporters and guides for hunting, fishing, photography, hiking, and boating excursions.

As discussed later in this section of the report, air traffic associated with numerous types of scientific investigations constitutes a significant portion of the NPR-A landings and takeoffs authorized in BLM land use permits. Permits for scientific research activities address a broad range of subjects, including hydrology, fish and wildlife, plant ecology, and climate change modeling.

The Borough Search and Rescue Department is active year round in training exercises, search and rescue operations, medical emergencies, and other activities that support other Borough departments. During the 12-month period ending July 1, 2013, NSB Search and Rescue logged 438 hours of flight time (Brower 2013 pers. comm.).

Lastly, and perhaps with the smallest impact, the U.S. Air Force completes flights to remote communication locations along the northern Alaska coastline.

One indicator of air traffic within the Borough is the volume of passengers flying into and out of various airports in or near the Borough. Table 4-1 lists airport activity likely associated with all six of the stated air traffic purposes. Passenger counts are rounded to the nearest thousand.

Additional insight into the source and purpose of air traffic within the NPR-A was gained through an analysis of information from BLM permits issued to applicants for land use activities.⁶³ BLM requires the applicants to estimate the number of landings and take offs for inclusion in the permits as well as the actual landings and takeoffs. For classification purposes the Borough has categorized land use and the associated takeoffs and landings as recreational, scientific and research, and oil and gas related. Table 4-2 is a summary of anticipated aircraft takeoffs and landings from BLM land use permits for 2011-2012.

Based on the limited data available, scientific research appears to be the largest contributor to air traffic within the NPR-A. Oil and gas related air traffic is not insignificant, and it increased faster than the other categories during the two-year period covered in the table. Recreational traffic is higher than what is reflected in Table 4-2 because many types of recreational use do not require a land use permit. Since BLM does not track landings and take-offs for activities that do not require a land use permit, the information in Table 4-2 represents only a subset of total air traffic within the NPR-A. Industrial airport activity is not included because data are not available. All forms of air traffic within the Borough create audible and visual disturbances that can potentially impact both caribou movements and subsistence hunters.

⁶³: Permits are not issued solely for aircraft use, so only those activities that trigger a land use permit are tracked.

Table 4-1: Airport Activity (June 2010-May 2011)

Route	Carriers	Passengers
Barrow to Anchorage	Alaska, Era	22,000
Barrow to Wainwright	Era Alaska	3,000
Barrow to Atkasuk	Era Alaska	2,000
Barrow to Deadhorse	Alaska, Era Alaska	1,000
Barrow to Point Lay	Era Alaska	1,000
Barrow to Nuiqsut	Era Alaska	1,000
Fairbanks to Barrow	Alaska	11,000
Fairbanks to Deadhorse	Alaska, Era Alaska	4,000
Fairbanks to Anaktuvuk Pass	Arctic Circle, Wright	3,000
Deadhorse to Barrow	Alaska, Era Alaska	2,000
Deadhorse to Nuiqsut	Era Alaska	1,000
Deadhorse to Kaktovik	Era Alaska	1,000

Source: Research and Innovative Technology Administration 2013

Table 4-2: Summary of Aircraft Takeoffs and Landings in Summer Permits for the NPR-A (2011-2012)

Purpose	2011	%	2012	%
Recreational	24	1	63	2
Oil and Gas	702	33	1585	41
Scientific/Research	1418	66	2217	57
Total	2144	100	3865	100

Source: BLM 2013⁶⁴

4.7.3 Mitigation of Impacts Related to Air Traffic

This section summarizes requirements of the FAA, the BLM, the State of Alaska and the NSB.

4.7.3.1 FAA Standards

FAA regulations (Title 14 of the Code of Federal Regulations) govern air travel in the United States. Most of these regulations apply to all aircraft operations, and certain regulations are specific to Alaska. Minimum altitude operational standards are addressed in subpart 91.177 (a)(2)(i), which specifies maintenance of an altitude of 1,000 feet above the highest obstacle within a horizontal distance of four nautical miles. There are no NPR-A-specific FAA regulations.

⁶⁴: Data for this table were obtained from spreadsheets provided by the BLM to the NSB. While this information is contained in permits for other years, the information has been tabulated in spreadsheets only for 2011 and 2012.

4.7.3.2 BLM Standards

The BLM strives to minimize the effects of low-flying aircraft on wildlife, subsistence activities and local communities associated with the activities it permits. Best Management Practice (BMP) F-1 requires permittees to meet a number of requirements summarized below unless doing so would endanger human life. These requirements also do not apply to research on birds.

- Permittees must submit an aircraft use plan as part of an oil and gas exploration or development proposal that specifies how flights will be monitored and identifies strategies to minimize impacts to subsistence activities (e.g., number of flights, type of aircraft, and flight altitudes and routes). The plans must be reviewed by the NSB and other agencies, and consultation is required if unacceptable disturbance is identified by subsistence users.
- During the design of proposed oil and gas facilities, larger landing strips and storage areas should be considered to accommodate larger aircraft which would reduce the number of flights.
- Hazing of wildlife by aircraft is prohibited; if wildlife begins to run as an aircraft approaches, the aircraft is too close and must break away.
- Aircraft over some areas require specific height and distances.
 - An altitude of at least 1,500 feet above ground when within ½ mile of cliffs identified as raptor nesting sites (April 15 - August 15) or when within ½ mile of known gyrfalcon nest sites (March 15 - August 15).
 - An altitude of at least 1,000 feet above ground (except for takeoffs and landings) over caribou winter ranges (December 1 - May 1).
 - An altitude of at least 2,000 feet above ground (except for takeoffs and landings) over the Teshekpuk Lake Caribou Habitat Area (May 20 - August 20) and the Utukok River Uplands Special Area (May 20 - August 20).
 - A minimum altitude of 2,000 feet (for fixed wing aircraft) and 3,000 feet and a one-mile buffer for helicopters when within a ½-mile of walrus haulouts.
 - A minimum altitude of 3,000 feet and one mile along the coast and shore fast ice when there are aggregations of seals.
- Aircraft use, including fixed wing and helicopters, should be minimized in certain areas:
 - In the Goose Molting Area (May 20 - August 20), and
 - Near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting).

A number of other lease stipulations and BMPs in the 2013 Record of Decision address air travel.

- **Airstrip Locations:** Air strips are prohibited within 500 feet of fish-bearing waters (Lease Stipulation E-2), adjacent to specified rivers (Lease Stipulation and BMP K-1), within one-fourth mile of lakes (Lease Stipulation and BMP K-1).
- **Limited Operations:** Aircraft is limited June 15 – August 20 over the Goose Molting Area (BMP K-4A) and within the Teshekpuk Lake Caribou Area (BMP K-5).
- **Plan Required:** Operations within the Teshekpuk Lake Caribou Area require submission of an aircraft use plan (BMP K-5).
- **Facility Design:** Facilities must include enough storage to minimize air support (BMP E-5).
- **Orientation:** An annual employee orientation must address information about impacts from aircraft on subsistence (BMP I-1).

4.7.3.3 State of Alaska Standards

In the 2008 best interest finding for the North Slope Areawide Lease Sale, two lessee advisories address flight restrictions (ADNR 2008b).

- **Calving and Wintering Caribou Habitat:** The Director of the Division of Oil and Gas may impose seasonal restrictions on flights over caribou or other ungulate calving and wintering in consultation with the Alaska Department of Fish and Game (Lessee Advisory 1).
- **Birds, Caribou and Muskox:** Horizontal and vertical buffers will be required to protect noise-sensitive species, consistent with restrictions in NSBMC 19.70.050(I)(1). The lessee is encouraged to apply the following buffers:
 - Avoid flights over identified brant, white fronted goose, tundra swan, king eider, common eider, and yellow-billed loon nesting and brood rearing habitat (June 1 – August 31),
 - Over fall staging areas for geese, tundra swans, and shorebirds, keep an altitude of 1,500 feet or a lateral distance of 1 mile (August 15 - September 15).
 - Aircraft should maintain an altitude greater than 1,500 feet or a lateral distance of one mile, excluding takeoffs and landings, from caribou and muskox (Lessee Advisory 8).

4.7.3.4 North Slope Borough Mitigation Measures

Title 19: The Title 19 Zoning Code includes some general direction for air traffic with more specific requirements in permit stipulations.

- **Noise:** Aircraft likely to cause significant disturbance must avoid areas where species that are sensitive to noise or movement are concentrated at times when such species are concentrated. Horizontal and vertical buffers will be required where appropriate and with concern for human safety (NSBMC § 19.70.030(I)(1)).
- **Wildlife:** Airstrips and helicopter pads must be sited, constructed and used to minimize impacts to wildlife.
- **Dalton Highway:** Recreational and residential use will be minimized at airports in the Transportation Corridor zoning district (NSBMC § 19.70.060).

Standard Stipulations: In addition to the Title 19 requirements above, some of which are repeated in permits, standard stipulations for NSB permits include the following requirements.

- **Plans:** Permittees must comply with transportation plans (General Stipulation 1).
- **Subsistence:** General Stipulation 6 requires that aircraft routes minimize impacts to subsistence activities. The routes must be filed with the NSB as well as a list of airplanes. Community consultation is required for some activities.
- **Design:** Nine Gravel Road and Airstrip Stipulations require compact design, non-duplication, and minimal impact on wildlife.
- **Timing:** Offshore General Stipulation 1 requires that nonessential air traffic occur outside of the whale migration period and that essential travel avoid disruption to whales.
- **Wildlife:** General Wildlife Stipulation 7 requires aircraft maintain altitudes that will avoid harassing caribou. General Wildlife Stipulation 7 requires permittees to provide the NSB with a photograph of each aircraft that will be used in its operation, clearly showing the tail numbers, prior to use of that aircraft.
- **Ice Airstrips:** Ice Road, Ice Pad and Airstrip Stipulations require approval of the landowner and removal of water only that is approved by ADNR.
- **Offshore:** Offshore General Stipulation 1 requires nonessential air traffic to occur prior to whale migration. It also requires that essential traffic be coordinated with the AEWC.
- **Caribou:** Specific Animal Stipulation 7 prohibits location of gravel pads, roads, airstrips, and pipelines within one mile of important caribou insect relief habitat. On a case-by-case basis, and in consultation with government agencies, essential pipeline and road crossings may be permitted through these areas where no other options are available.

Coastal Management Enforceable Policies: A number of enforceable policies from the 2007 draft NSB Coastal Management Plan address pipelines.

- **Height and Distance Restrictions:** Policy A-4 required a minimum flight altitude of 1,500 feet above marine mammals and caribou during times of subsistence use, when there are concentrations of 50 or more caribou, during caribou calving periods, and during other specified sensitive time periods. Policy C-6 established a buffer of 1,500 feet above marine mammal haul-out areas and seabird colonies. Policy C-9 established a minimum 1,500 feet for aircraft above bear dens and seal lairs.

4.7.4 Conclusions

Over the past decade, agencies have improved measures to reduce impacts from air traffic to wildlife and subsistence users. Agencies, in lease sale and permit stipulations, continue to require vertical and horizontal buffers over areas with sensitive wildlife and seasonal restrictions. In some cases, these buffers are also imposed when subsistence users are present. BLM implemented a number of measures in its 2013 record of decision for the NPR-A to restrict air traffic over specific sensitive areas. In recent years, BLM has required that permittees estimate anticipated takeoffs and landings and report on actual activity, although this information has been tabulated for only two years. The actual and potential impacts to subsistence uses and resources from air traffic continue to be an important issue among subsistence users. Recommendations to address outstanding issues related to air traffic, including better tracking of landings and takeoffs, may be found in Section 5.7.

4.8 Dismantlement, Removal and Restoration

Dismantlement, removal and restoration (DR&R) requirements are important to the NSB because the future condition of the land will affect how Borough residents can use it. The people of northern Alaska have lived in the region for thousands of years, and they will continue to occupy the area long after oil and gas activities have ceased.

DR&R is a term common to the oil industry that refers to actions taken after oil facilities are no longer needed. These actions may range from removing all improvements and restoring the area to its original condition, to some form of enhanced rehabilitation (e.g., providing functional habitat that previously did not exist), to simply removing some or all of the structures. The terms restoration and rehabilitation are also used when referencing DR&R activities. While these terms are often used interchangeably, they have distinct meanings.

As mentioned in Chapter 1, a 2002 report on DR&R by the General Accountability Office (GAO) provided one of the primary reasons for initiating this project. Although over ten years have passed since that report was published, it remains a definitive source of information about DR&R, and most of the issues it addresses are still relevant.

Activities that result in a need for DR&R on the North Slope involve oil and gas development and production, and to a lesser extent, early exploration activities. Although current exploration activities mostly occur during the winter using ice roads and ice pads, older exploration activities, such as those that occurred in the NPR-A, were completed before current environmental practices were in place. Some older exploration sites still need to be rehabilitated (see Section 2.3.3.1).

DR&R requirements are imposed by government agencies and private land owners. Lands within the boundaries of the NSB are owned by the Borough, State of Alaska, federal government, and private entities. Most private land is owned by the Arctic Slope Regional Corporation and village Native corporations. Native allotments and townsites are a special category of lands that are held in trust by the federal government, and most activities on these lands are not regulated by state or local agencies.

The remainder of this section begins with an overview of issues followed by a discussion of DR&R experience on the North Slope. It continues with a summary of existing requirements and ends with an analysis of outstanding issues that still need to be addressed.

4.8.1 Overview of Issues

The major DR&R issues of concern to Borough may be summarized into the following categories: Timing of when DR&R will occur, unclear expectations, lack of a clear process, and uncertainties regarding a company's ability to finance restoration and rehabilitation activities. Each of these issues is discussed in more detail in sections 4.8.1.1 – 4.8.1.4.

4.8.1.1 Timing of DR&R

Although plans for DR&R may be required at the permitting stage, specific decisions about the disposition of oil and gas infrastructure on the North Slope are postponed until the facilities are abandoned. Operators have a certain amount of discretion to determine when a facility is abandoned.

In some cases, companies may choose to postpone DR&R activities due to monetary concerns. For example, in the Cook Inlet area, offshore operators have delayed the ultimate expense

Restoration & Rehabilitation

For the purposes of this report, these terms are defined as follows.

Restoration: Repair of damage caused by human activity or natural events by reestablishing habitat features, species and processes that were present prior to disturbance.

Rehabilitation: Repair of damage caused by human activity or natural events by returning it to a functional habitat for plants and animals without complete restoration to its original condition.

of abandoning non-producing, uneconomic platforms using a practice called lighthousing.⁶⁵ The Spurr and Spark platforms haven't produced oil since the early 1990's, and the Middle Ground Shoal, Baker and Dillon platforms last produced oil around 2003. Minor gas production was re-initiated, albeit sporadically, from the Baker platform two years after oil production ceased. Likewise, gas production from the Spark platform was re-initialized five years after oil production ceased in 1992, continued for three years, and was shut-in again for almost four years only to be restarted for four more years in 2003. The platform has remained dormant since mid-2007. In addition to postponing abandonment costs, lighthousing also allows operators to preserve the option of restarting the facility in the advent of improved operating efficiencies, technologies or investments.

The Badami field on the eastern North Slope provides an example of the benefits of delaying a decision to abandon facilities to preserve future development opportunities. BP began production from the 120-million-barrel field in August 1998 with an expected flow of 30,000 barrels a day. The flow actually peaked at about 7,450 barrels a day two months after start up and dropped to 3,300 barrels a day within months. BP shut down production between February and May 1999 because the winter flow was too low to operate the pipeline. Subsequent efforts to boost production were short-lived and BP suspended operations in 2003 when production was about 1,100 barrels a day and dropping rapidly. Two years later production resumed, but BP closed the field again in 2007 to let the reservoir recharge. In late 2008, Savant Alaska and ASRC joined the project, and in 2009, Savant drilled a well that ultimately resulted in production from a second reservoir in the area, and Savant became the field operator in late 2011. Figure 4-6 depicts the oil production history of the Badami field.

As a result of this renewed effort to maximize development opportunities at what could have been an abandoned asset, Borough property tax receipts for Badami doubled since 2009. Additionally, the previously shut-in Badami oil sales pipeline is playing a pivotal role in expanding North Slope development and infrastructure for Point Thomson development, and possibly beyond.

4.8.1.2 Unclear Expectations

The expectations for final restoration and rehabilitation of oil and gas facilities are not clear. State and federal agencies have general requirements, but lease stipulations are not very specific. The BLM requires that infrastructure be reclaimed to restore ecosystem function, while the ADNRC requires that infrastructure be removed unless approved otherwise. There is no clear agreement among agencies regarding how the land will be restored or rehabilitated. The 2012 NPR-A IAP/EIS, however, does include a discussion of possible actions once facilities are abandoned. The GAO (2002) found that operators would prefer more specific requirements that would allow them to make more accurate estimates of future financial liabilities.

⁶⁵: "Lighthousing" refers to the practice of delaying abandonment by maintaining the structural integrity of non-producing facilities. It includes adding lighting as a navigation and safety aid.

4.8.1.3 Lack of a Clear Process

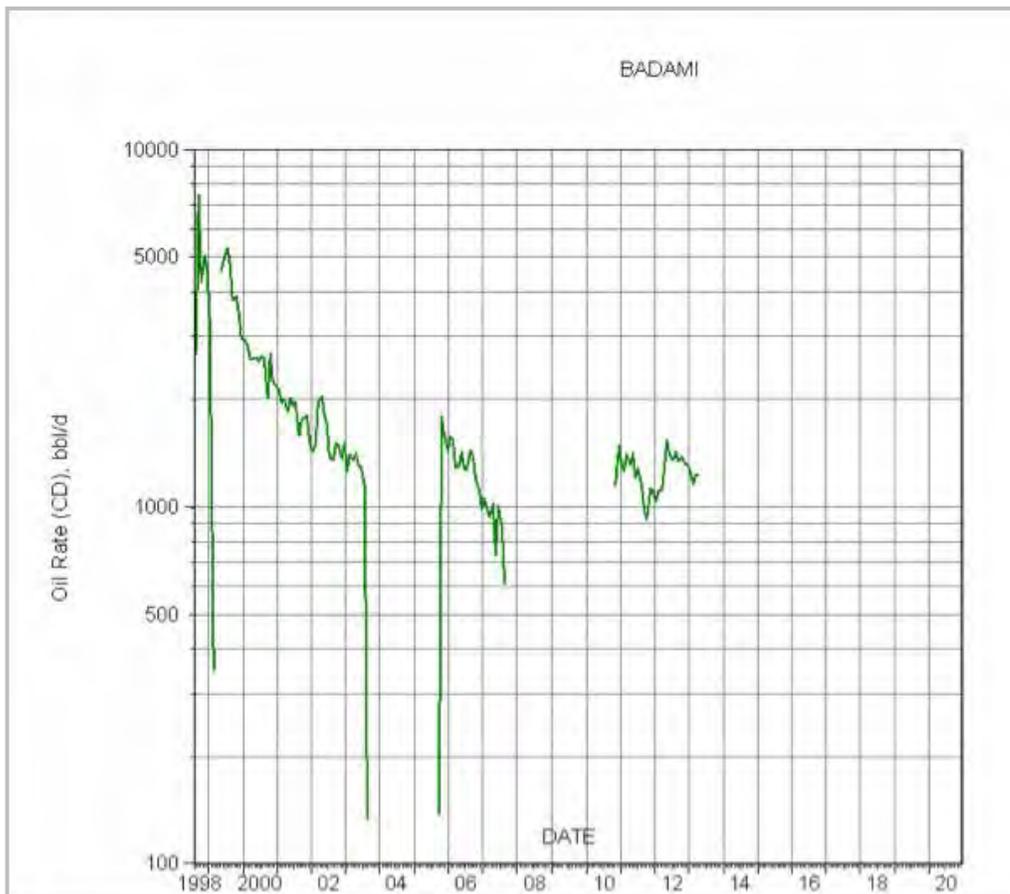


Figure 4-6: Oil Production History for the Badami Field

Source: Alaska Oil and Gas Conservation Commission 2013

There are no well-defined processes established to assess current or future rehabilitation needs on a North Slope-wide basis (North Slope Science Initiative 2013b). On a case-by-case basis, agencies track individual rehabilitation efforts, but this does not occur at a landscape level.

In addition, there are no clear processes for how decisions will be made once facilities and infrastructure are no longer needed. While both the BLM and ADNR require companies to submit reclamation plans, the actual process that will be used once a major facility is abandoned is not clear. The BLM specifically states in the 2013 ROD that it may grant exceptions for environmental or public purposes. The ADNR requires that facilities be removed unless it determines that removal is not in the state's interest. Other than stating that it will consult with other resource agencies and the NSB, ADNR does not explain the process for making final decisions about DR&R at the abandonment stage.

The Borough recognizes it may be advantageous to repurpose roads, pads and other infrastructure once oil and gas operations end. Facilities may be of use to the Borough, its communities or new industries. While it is not possible to anticipate what facilities may be needed in the future, the Borough believes a process for making future decisions should be established now. In addition, a dialogue is needed to address potential legal issues around liability and who owns, operates and maintains the facilities.

4.8.1.4 Financial Responsibility

The financial capacity of oilfield operators to complete DR&R requirements is an important concern to the Borough. DR&R will likely cost more on the North Slope than in other areas of the country due to its remoteness, costs of doing business and the harsh climate.

Financial assurances required by agencies represent a small fraction of what will be needed to rehabilitate and restore the land on the North Slope, and agencies use different requirements. Current State of Alaska bond requirements include \$200,000 for each company's statewide drilling operations and \$500,000 to cover a company's statewide oil and gas leases in total. BLM only requires a company to obtain a \$300,000 bond for all leases the company holds in the NPR-A.

Without adequate financial responsibility required up front, there is a risk that operators may not be able or willing to restore the lands and waters adequately. While many of the current North Slope operators are large companies with sound finances, assets will likely be transferred to smaller companies as fields decline and profit margins decrease. These smaller operators will not have the same resources to execute DR&R obligations, and some may be vulnerable to bankruptcy.

Typically, petroleum company DR&R estimates are only provided on a corporate-wide basis, without specific costs attributable to a particular region or project. The GAO (2002) took advantage of a merger to estimate DR&R costs for one company, and it estimated that North Slope-wide costs will be in the billions of dollars.⁶⁶ To further complicate the situation, government agencies have not standardized how DR&R costs should be calculated.

4.8.2 DR&R Experience on the North Slope

Although reclamation success for larger oil and gas production facilities, pipelines, roads, and other infrastructure is untested, experience with restoration and rehabilitation of smaller sites is growing. As of 2013, industry and agencies were monitoring over 100 individual rehabilitation sites on the North Slope (North Slope Science Initiative 2013b). Most sites have footprints of less than an acre, and large sites are typically no bigger than five to ten acres,

⁶⁶: The GAO was able to estimate assets acquired by Phillips Petroleum when it purchased ARCO's property on the North Slope by comparing the former company-wide DR&R estimates with the new estimates after acquiring ARCO's property.

with the exception of gravel mine sites that can exceed 140 acres impacted areas. The major types of DR&R experience on the North Slope are discussed below.

Early Abandoned Sites: Experience rehabilitating early exploration sites in the NPR-A provides some insight of the difficulties and expenses related to DR&R (see Section 2.3.3.1). Military activities across the North Slope have also resulted in sites that need decontamination and rehabilitation.

Other experience with abandoned facilities on the North Slope includes the Crazy Horse Pad and the one-time cleanup of an area located near Prudhoe Bay called Service City. As summarized by the GAO (2002), beginning in the 1960s companies used Service City as a staging site for oil and gas activities. By 1986, the area was no longer used, but buildings,



Drill site with thermokarst
(Photo: Gordon Brower)

batteries, equipment, and other debris remained. In 1990, the state revoked area leases due to inactivity and nonpayment of fees, and in that same year BP led an effort to clean up Service City through a cooperative agreement among the State of Alaska, ARCO, and ExxonMobil.



Tundra travel damage
(Photo: Gordon Brower)

Tundra Travel: Damage from tundra travel activities, although rare, occurs when vehicles are too heavy, when summer travel occurs after periods of heavy rain, and when ice roads are constructed in low snow areas on dry upland sites (tussock tundra). Ice roads do not normally need rehabilitation and areas generally recover naturally within 10 years. About one percent of seismic tails need longer time

period to recover. Treatment includes replacement of dislodged tundra and application of

fertilizer (North Slope Science Initiative 2013b). Occasionally it is necessary to re-sod areas using materials from donor areas such as new mine sites.⁶⁷

The NSB has required restoration of sites disturbed by tundra travel. This experience, however, is limited because the most recent exploration efforts result in few impacts due to use of ice roads and pads, tundra travel restrictions and the absence of infrastructure needed for production.

Abandoned Gravel Sites: Early rehabilitation efforts involved seeding of gravel structures, but re-vegetation efforts were seldom successful. Without intervention, less than one percent of vegetative cover occurs after three years. Rehabilitation efforts have been more successful when gravel is removed to near-tundra level, and beginning in 2000, removal of all or part of gravel from abandoned roads, pads and airstrips became more common (North Slope Science Initiative 2013b). If not contaminated, this gravel provides a source for new facilities and reduces the need for new mine sites. Without removal of gravel, seeds are hampered by a lack of nutrients, organic matter and moisture. Experience has shown that seeding of native grass on gravel structures may slow the development of a more natural plant community, so fertilizer is often spread with natural recruitment of plants or by using sedge seeds. A goal of ten percent plant cover by native species after ten years has been found to be a realistic expectation.



Cutting sod with specialized equipment at Point Thomson
(Photo: ExxonMobil)

Pad Rehabilitation: BP first used sod to rehabilitate disturbed sites in 2006. In 2013, ExxonMobil used sod to rehabilitate the 0.8 acres of the existing C-1 Pad and a portion of the airstrip as part of its development of the Point Thomson Project (Calder and McKim 2014). The rehabilitation involved removing gravel and insulation from the portion of the C-1 Pad subject to rehabilitation. ExxonMobil used specialized equipment to cut the sod into four by eight foot tiles from a nearby mine site. Excavators removed the tiles and placed them along the outer portion of the C-1 Pad restoration site. Soil was placed between the tiles and in the center of the rehabilitated area, and the interior portion was seeded with four species of native grasses. As an experiment, sod tiles were used to stabilize 209 square feet of side slopes on the air strip. Another experimental aspect of the project involved overwinter storage of sod tiles stacked 10 layers high, separated by plastic sheets and covered with a tarp.

⁶⁷: Sodding techniques have been developed using traditional knowledge of local residents based on techniques for roofs for homes and ice cellars (Cater 2010).

Oil Spill Sites: Areas contaminated by oil spills sometimes require removal of the tundra and backfilling with clean materials. Although these areas can be restored by using sod from other areas, seeding and fertilizing is another technique used when sod is not available. Native grass seed is commercially available, but its use has been found to inhibit natural regeneration on gravel surfaces. The use of native forbs can be more successful, but these seeds must be collected manually from the tundra.

Reserve Pits: Reserve pits have been used to store muds and cuttings from drilling operations. While current practices involve use of contained areas, early activities involved use of unlined pits. After removal of contaminated materials, pits are backfilled with gravel, or if the pad is no longer used, the area is backfilled using a combination of gravel and mineral soils to a slightly above grade level.

Trenched Areas: Sites trenched for burying of cables and pipelines are generally backfilled and seeded. These areas, however, can result in thermokarsting (hydraulic and thermal erosion) which sometimes occur after many years. In some cases, it is necessary to repeatedly backfill and seed trenches.

Gravel Mine Sites: While industry obtained early sources of gravel by scraping areas in flood plains, mine sites are currently used for gravel. Reclamation of gravel mine sites often involves construction of waterbodies deep enough for overwintering fish with a channel excavated to nearby streams to allow fish access. The Alaska Department of Fish and Game (1993) has developed accepted practices for rehabilitation of gravel on the North Slope.

In addition to experience with individual sites, the State of Alaska negotiated rehabilitation activities with two oil companies as part of a merger in 1999 (State of Alaska et al. 1999). This agreement involved a commitment to spend at least \$10 million to restore “orphan sites”, remove empty barrels and cleanup of existing BP and ARCO sites on the North Slope. This agreement was part of a charter associated with acquisition of ARCO Alaska, Inc. by BP Exploration (Alaska) Inc.⁶⁸

There are many challenges relating to DR&R on the North Slope, including the size of the



Lifting sod with excavator at Point Thomson
(Photo: ExxonMobil)



Placing sod with excavator
(Photo: ExxonMobil)

68: According to the Alaska Department of Environmental Conservation (2013b), the charter was the first antitrust agreement to include environmental provisions.

infrastructure which includes thousands of wells and hundreds of miles of pipelines, flowlines, roads and other and other facilities.⁶⁹ Conditions challenging re-vegetation efforts include a limited amount of precipitation, extreme winter cold temperatures, a short growing season, low nutrient availability in the soils, and grazing by animals. An absence of seed sources for upland sites also poses another challenge. In some instances, it may not be possible to restore an area to its previous condition. For instance, disturbance causing thawing of permafrost soils can be difficult to reverse. Citing a 2001 report by the Alaska Oil and Gas Association, the BLM states that “Natural recovery of disturbed sites to original soil and plant conditions has been estimated to require 600 to 800 years for upland sites and 100 to 200 years for marsh sites” (BLM 2012a, Vol. 4, p. 63). The 2012 NPR-A IAP/EIS indicates that dry sites affected by diesel fuel spills recover very slowly, and tundra disturbed by vehicles can take decades to recover. Areas near the coast are colder and therefore recovery is longer with fewer species. In addition, the BLM found that effects of climate change may make rehabilitation of sites to former vegetation impractical. As a result of these challenges, monitoring efforts are a long-term prospect.

Some standards for tundra rehabilitation have been developed (Cater 2010, Oasis Environmental 2004). In addition, monitoring criteria included on agency permits address performance standards, including the amount of vegetation cover, species richness and soil stability. In addition, industry and agencies have been holding annual meetings to track progress of restoration and rehabilitation efforts.

Reclamation and restoration efforts for the smaller sites described above have generally been sufficient. The effort and cost to remove more permanent large oil and gas production facilities, pipelines, roads, and other infrastructure, however, will be an entirely different order of magnitude.

4.8.3 Mitigation of Impacts Related to DR&R

State and federal agencies and the NSB have the ability to regulate DR&R activities within the Borough and its offshore waters. Additionally, private landowners such as ASRC also have the ability to impose DR&R requirements within the lands they own. Specific decisions about how areas will be restored or rehabilitated, however, are made at the time of abandonment.

4.8.3.1 State of Alaska DR&R Requirements

The three main state agencies responsible for DR&R are the Alaska Department of Natural Resources (ADNR), the Alaska Oil and Gas Conservation Commission (AOGCC) and the Regulatory Commission of Alaska (RCA). The Alaska Department of Environmental Conservation (ADEC) and the Alaska Department of Fish and Game (ADFG) also regulate certain aspects of restoration and rehabilitation.

⁶⁹: In 2002, the GAO estimated that oil and gas infrastructure on the North Slope was worth \$53 billion.

The GAO (2002) found that State of Alaska requirements for DR&R were general in nature without specific requirements. The GAO report states that “Alaska’s requirements specify that the oil companies have to return the land to a condition that is satisfactory to the state – a condition that it has yet to define” (GAO 2002, pp. 7-8).

Alaska Department of Natural Resources (ADNR): Most of the oil development on the North Slope has occurred on state land, and the ADNR is responsible for oil and gas leasing and regulation of activities on state lands and waters. As a land management agency, ADNR plays a critical role in determining how oil development facilities will be addressed when operations cease. ADNR may include DR&R provisions in unit agreements, lease agreements or permits (i.e., in an approval for a plan of operations). Some older leases have no specific rehabilitation provisions (GAO 2002).⁷⁰

As an example of DR&R requirements by ADNR, Mitigation Measure 1.j for the North Slope Areawide oil and gas lease sale states the following.⁷¹

Upon abandonment of material sites, drilling sites, roads, buildings or other facilities, such facilities must be removed and the site rehabilitated to the satisfaction of the Director, unless the Director, in consultation with DMLW, ADF&G, ADEC, NSB, and any non-state surface owner, determines that such removal and rehabilitation is not in the state’s interest (Alaska Department of Natural Resources 2008, p. 7-8).

This clause does not specify what criteria will be used to determine if a site has been adequately rehabilitated, and the director has discretion to leave facilities in place if it is in the State’s interest. While these measures require consultation with the NSB and state resource agencies, the decision rests entirely within the discretion of the ADNR.

Lease sale measures also require certain performance guidelines for rehabilitating gravel mine sites (North Slope Areawide Mitigation Measure 1.k and Beaufort Sea Mitigation Measure 1.m).

In response to the draft GAO report, the State of Alaska stated that it believes it needs discretion to consider the technological and regulatory conditions present at the time when facilities are decommissioned (GAO 2002, p. 15). ADNR also responded to concerns about the lack of specific DR&R requirements in ADNR’s state regulations during a 2009 state lease sale, ADNR responded:

Dismantlement, removal, and remediation is addressed in state regulations

70: One former lease stated only that the lessee must “deliver up said lands in good order and condition” (GAO 2002, p. 38).

71: Mitigation Measure 1.l of the Beaufort Sea Areawide lease sale best interest finding included a similar provision.

concerning plans of operation (11 AAC 83.158(d)(3)). A plan of operation must be approved by DO&G before any operations may be undertaken on or in the leased area. An application for approval of a plan of operations must include 'plans for the rehabilitation of the affected leased or licensed area after completion of operations or phases of those operations.' This regulation gives DO&G the ability to require, review, approve, and monitor plans for DR&R at the outset of oil and gas operations and must include 'plans for the rehabilitation of the affected leased or licensed area after completion of operations or phases of those operations' (ADNR 2009a, p. A-21 – A-22).

The state requires bonds and financial assurances, but these "amounts represent a small fraction of the funds that may be needed for dismantlement, removal, and restoration of state lands on the North Slope should a company refuse to or be unable to pay" (GAO 2002, pp. 8-9). The GAO, however, found that Alaska's bonding amounts are generally higher than other major oil-producing states.

Alaska Oil and Gas Conservation Commission (AOGCC): The AOGCC, a state agency within the Alaska Department of Administration, manages subsurface oil and gas resources by issuing permits for wells drilled on state, federal and private lands in Alaska. The agency aims to protect the public interest in Alaska's oil, gas and geothermal resources by ensuring adequate recovery of the resources, and protection of health, safety, and groundwater resources. It also protects the rights of owners to recover their share of the resource.

AOGCC ensures that exploration and production wells are plugged and abandoned when they are no longer of commercial use. It also ensures that the area around the wells are cleaned up and restored. AOGCC's regulations specify the accepted method for plugging and abandoning wells (20 AAC 25.105-172). The primary purpose of these regulations is to protect subsurface hydrocarbon reservoirs and aquifers and avoid contamination, fire, gas leaks, and cross-flow from one reservoir to another. The regulations require cement plugs and metal caps to seal off abandoned wells. AOGCC's regulations have been successfully used to ensure proper abandonment of a number of wells in the NSB.

In addition to plugging and abandonment requirements, the AOGCC also requires rehabilitation of the surface area around a well through provisions in what is known as location clearance. These provisions are not specific as to the physical reach of DR&R around the well site, and AOGCC's regulations defer to the relevant state or federal land management agency for the appropriate level of DR&R. The location clearance requirements include removing equipment and associated infrastructure, filling and grading pits, and leaving the area in a clean and graded condition before granting final clearance and returning the surety bond. No location clearances have been granted for the North Slope because this clearance is given only after all wells on a well pad are plugged and abandoned, and no development drilling pads have been completely abandoned.

Regulatory Commission of Alaska (RCA): The RCA administers DR&R requirements for oil and gas pipelines under Alaska Statutes (AS) 42.06. Over the last 40 years, hundreds of miles of oil and gas pipelines have been constructed on the North Slope to support oil development. While RCA has statutory authority to make decisions about abandonment, the primary purpose of its pipeline abandonment plans is to prevent premature decommissioning a pipeline that is required for “public convenience and necessity” (AS 42.06.290). RCA also has authority to require insurance and security to hold a pipeline operator liable for damages from pipeline construction and operation (AS § 42.06.280).

In 2006, the RCA considered changes to its regulations regarding DR&R. The NSB submitted comments supporting revisions to the regulations to ensure financial assurances are in place between the State of Alaska and each pipeline owner to cover eventual DR&R costs. A June 20, 2006 decision adopted requirements for filing supporting information, but the RCA determined the proposed annual reporting of DR&R information for 3 AAC 48.422 was not required.

4.8.3.2 Federal Agencies Responsible for DR&R in Alaska

The GAO (2002) found that DR&R and requirements and financial assurances for federal lands on the North Slope vary by agency and “are generally insufficient to ensure that any federal lands disturbed by oil industry activities will be restored” (p. 9). As described below, a number of federal agencies have DR&R responsibilities for the North Slope.

Bureau of Land Management (BLM): The BLM has responsibility for oil and gas activities within the NPR-A. Its overall restoration goal at the end of production is to return the land “to its previous condition and use, which largely includes fish and wildlife habitat” (BLM 2012, p.40).⁷² Although the agency has authority to require full financial assurances for DR&R, its bonding requirements cover “only a fraction of the funds potentially needed to meet the future dismantlement, removal and restoration costs” (GAO 2002, p. 10). The agency uses standard bonding requirements without regard to the experience or financial situation of individual companies.

BLM regulations provide the agency authority to attach stipulations to oil and gas leases (43 CFR § 3131.3) requiring the operator or lessee to post bonds (43 CFR § 3104.1 and § 3160) and develop detailed plugging and abandonment and surface restoration plans at unit termination (43 CFR § 3137.135). The BLM implements abandonment and reclamation requirements through the approval of plans (43 CFR § 3162. 3-4 and 3162.5-1).

In its 2002 report, the GAO has recommended that the Secretary of the Interior direct BLM to develop specific DR&R requirements to meet its restoration goal. The GAO also recommended

⁷²: Lessees are required to develop plans for abandonment and reclamation which are enforceable after approval by BLM (43 CFR § 3162.3-4 and § 3162.5-1).

that the BLM review its financial assurance requirements to determine whether they are sufficient to meet the agency's restoration goal for the NPR-A. The BLM, however, has not developed specific DR&R requirements.⁷³ Further, the GAO suggested that Congress should consider establishing a clear restoration goal and specific financial assurances.

The November 2012 Final Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) for the NPR-A addresses DR&R requirements, impacts and challenges. The IAP/EIS identifies the following impacts from DR&R activities and needs for continued work and monitoring.

- Dust would be deposited on the tundra similar to that from construction activities.
- If roads and pads are left in place, there may be drainage problems if culverts and bridges are not maintained. This situation could result in the alteration of plant communities.
- Non-maintained roads could be washed out resulting in gravel placement on the tundra.
- Restoration of roads and pads left in place will require re-vegetation with plants endemic to gravel bars and ridges and this may result in different vegetation than currently exists.
- It would take many years to reestablish native plants; initial attempts are not always successful.
- Subsidence could occur, so a return to pre-construction condition is not likely.
- Monitoring of landfills will be necessary to ensure adjacent areas are not contaminated.

The February 2013 Record of Decision for the IAP/EIS includes lease sale stipulation G-1 which requires facilities to be reclaimed to restore original ecosystem function, including pads, production facilities, access roads, and airstrips (BLM 2013b). It requires that abandonment and reclamation plans 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 2012 NPR-A IAP/EIS discussed a range of possible DR&R options as summarized in the following bullets.

- Roads may be re-vegetated and left in place, bridges and culverts may be removed, sections of roads may be breached to restore more natural drainage patterns, or roads may be removed to fill material sites or re-use for other developments.
- If no longer needed, bridges would be dismantled and materials would be removed from the area, recycled or disposed of.

⁷³: According to the GAO (2002), "the Trans-Alaska Pipeline System and the mining and nuclear power industries have explicit dismantlement, removal, and restoration requirements that are set before any industry activities start" (p. 10).

- Gravel pads could be removed with the tundra re-vegetated. If left in place, they could be re-vegetated or re-purposed for other uses.
- Material sites could be filled with gravel from reclaimed areas or connected to streams to provide new habitat for overwintering fish.
- Airstrips could be removed or left in place for continued use.
- As required for the Trans-Alaska Pipeline System, above ground pipelines could be removed and the ground restored or cleaned, capped.
- Wells would be plugged and capped.
- Materials would be removed, reused, recycled, or disposed of according to regulations.

The BLM acknowledges that abandonment would take many years and require monitoring of re-vegetation efforts. According to the BLM (2012a), normally a three-person crew visits sites annually for the first five years with increasing time gaps over the next ten years.

Lessees are required to provide financial assurance through bonds to comply with lease requirements, including DR&R requirements (43 CFR Part 3130, subpart 3134). As mentioned earlier, BLM's bonding structure does not cover sufficient funds to complete DR&R.

Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and

Environmental Enforcement (BSEE): BOEM and BSEE regulate oil and gas activities within federal waters, generally those waters greater than three nautical miles from shore. Both agencies are within the Department of the Interior and were previously part of the former Minerals Management Service (MMS). The GAO (2002) found that unlike other agencies, MMS had specific DR&R requirements as well as an escalating bond structure.

U.S. Army Corps of Engineers (ACOE): The ACOE issues permits for development activities in wetlands and navigable waters, regardless of land ownership. Through its permitting authorities, it has the ability to impose DR&R requirements, but it has not done so (GAO 2002). Today the ACOE is actively involved in DR&R and has permit stipulations in 404 permits and have in the past taken action to enforce these stipulations.

Other Federal Agencies: Other federal agencies that regulate oil and gas activities include the National Marine Fisheries Service, the U.S. Fish and Wildlife Service (USFWS), and the Environmental Protection Agency. Of these 3 agencies, the USFWS is the only land management agency. It manages the Alaska National Wildlife Refuge (ANWR), and since there is a Congressional ban on oil and gas activities in ANWR, the USFWS does not have DR&R requirements for the refuge.

4.8.3.3 North Slope Borough Regulation of DR&R

The NSB regulates oil and gas activities on state, federal and private lands within its boundaries under its Title 19 zoning and land use code. The Department of Planning and Community Services routinely issues administrative authorizations (NSBMC § 19.50) to companies conducting oil and gas activities, and the Planning Commission approves conditional uses (NSBMC § 19.60).

Title 19 of the NSB municipal code provides general guidance that could be applied when developing DR&R measures for Borough permits (NSBMC § 19.10.020). The code specifically provides authority to require reclamation plans either prior to the final approval of a proposed development or at a date prior to the cessation of the activity. It specifically states that NSB cannot conflict with reclamation requirements of other government agencies. If required, a reclamation plan must include in part:

- A grading and site plan,
- Reclamation methods and plans of the site with a timetable, and
- A description of roads and structures with a site map indicating which roads and development will remain after activities are completed (NSBMC § 19.30.070 (B)).

The Borough code also gives authority to require a surety for a use or development (NSBMC § 19.30.070 (A)). This provision allows the surety cover up to 100% of the estimated cost of reclamation or mitigation. The financial assurance may be provided by self-insurance, proof of financial responsibility or existence of a sufficient surety that has been filed with another government entity.

While the Borough has the ability to impose DR&R requirements, it has generally deferred to state and federal agencies with the exception of permit stipulations requiring rehabilitation of exploration projects to pre-exploration conditions. As described later in this section, while the Borough has the ability to require a reclamation plan at the project approval stage, it usually requires that a plan be submitted by 12 months after cessation of operations. Absent that plan, NSB does not have a specific commitment to the level of DR&R that will be achieved on each project.

For long-term projects, the NSB usually includes a stipulation in permits that specify the Borough's expectations for abandonment. General Stipulation 9 requires approval from the NSB for requests to abandon, cease maintenance or transfer permitted facilities to a third party. This stipulation clarifies that the permittee is liable for all the costs associated with removal, restoration and re-vegetation of the area. It also states that the NSB will establish removal, restoration and re-vegetation requirements.

For short-term projects, such as exploration drilling, seismic, construction, and ice road use, the NSB requires oil and gas operators to submit a report within 60 days of completion of activities

(Standard Stipulation 13). Among other information, the report must describe any clean-up activities and include photographs showing how the area was cleaned and remediated to its original state.

Planning Department inspectors and NSB Department of Wildlife Management staff have worked closely with industry to improve methods for re-vegetating and rehabilitating these areas. As an experiment, in 2013 Great Bear Petroleum segregated native plants excavated from its Alcor #1 drill site with plans to replace them once the drilling completed.



Alcor #1 Drill Site with Native Plants Stored for Future Use
(Photo: Dudley Platt)

In addition to the provisions described above, the NSB also implements other measures to restore lands. For instance, permits generally require immediate cleanup and reclamation of area affected by oil spills or tundra damage. The following additional requirements apply to activities within the Transportation Corridor district.

- Extraction must be conducted in accordance with reclamation plans that provide for enhancement to wildlife habitat, minimization of environmental impacts or improvements to human use of the affected area (NSBMC § 19.70.060(E)).
- Reclamation of all upland and floodplain mined sites shall be required unless such reclamation would cause greater adverse impact to the environment than leaving the area un-reclaimed. Excavated areas should be converted to fish or waterfowl habitat whenever feasible and prudent (NSBMC § 19.70.060(F)).

Coastal Management Enforceable Policies: Policy E-3 of the 2007 draft NSB Coastal Management Plan required that applicants include a plan for DR&R with the application that identified at what point in the project development the measures will be implemented. It also required identification of resources available to fund DR&R. The policy stated that to the maximum extent practicable and to the satisfaction of the borough, the measures shall be designed to return the area to pre-project conditions, especially with regard to habitat functions and visual impacts to the landscape. It required that measures be implemented when a facility is no longer being used and when there are no specific plans for future use unless

otherwise agreed upon with the NSB. Lastly, it included a provision to review the original required measures to determine if there is a demonstrated future use for the site, or the original measures would cause greater adverse effects.

4.8.3.4 Native Corporation Authority for DR&R

The Arctic Slope Regional Corporation (ASRC), the regional Native corporation for the North Slope region, owns about five million acres of lands on the North Slope. While village Native corporations own surface rights for lands they own, ASRC retains subsurface rights for these lands. These corporations have the ability to require DR&R measures, and such measures could be required through contract clauses.

4.8.3.5 Other States

According to the GAO (2002), State of Alaska DR&R requirements are similar to some other states, but less explicit (p. 8). The requirements are similar to those in Louisiana and Pennsylvania, but Florida and New Mexico require removal of structures and restoration of the land to its original contours (p. 11). An analysis of these requirements is beyond the scope of this report but may be a useful future project.

4.8.4 Conclusions for DR&R

A number of state and federal agencies and the NSB have authority for DR&R. While there are more than 100 restoration and rehabilitation projects tracked on the North Slope, there is no slope-wide system to track them. Current DR&R activities have been for smaller sites since major production facilities have not yet been abandoned on the North Slope. Waiting until sites are abandoned to impose specific requirements results in different expectations about how the land will be rehabilitated, and it makes it difficult for operators to estimate future DR&R costs. While agencies require lessees to prepare reclamation plans, no independent analyses of the effectiveness of these plans have been conducted, and agencies have great discretion in how the plans will be eventually implemented. In addition, the process and criteria that will be used to decommission abandoned facilities have not been developed. Lastly, financial assurance requirements are not commensurate with the eventual costs of DR&R. While larger companies have the ability to fund restoration and rehabilitation, it is likely that assets will be sold to smaller companies as the North Slope oil fields age. Smaller companies do not have the same financial resources as larger companies, and it is not certain that they will be able or willing to complete the large-scale DR&R that will be needed when the oil fields stop producing.

