June 28, 2010

HEALY BASIN GAS ONLY EXPLORATION LICENSE

Final Finding of the Director

Alaska Department of
NATURAL RESOURCES
DIVISION OF OIL & GAS

Alaska Department of Natural Resources
Division of Oil and Gas
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Prepared by:
Alaska Department of Natural Resources
Division of Oil and Gas

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Table of Contents

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

List of Tables

List of Figures

List of Maps

Chapter One: Executive Summary

Table of Contents

List of Maps

Chapter One: Executive Summary

The State of Alaska, Department of Natural Resources (ADNR) has determined that issuing a gas-only exploration license in the Healy Basin to Usibelli Coal Mine, Inc. (UCM) is in the best interests of the state of Alaska. The exploration license area consists of 208,630 acres located within the Fairbanks Meridian (Map 1.1). The license area contains land in which the state owns both the land estate and the mineral estate; and land where the state owns just the mineral estate, while the land estate might be either privately owned or owned by a municipality. Only free and unencumbered state-owned mineral estates will be included in the gas license. The applicant excluded certain other lands as well.

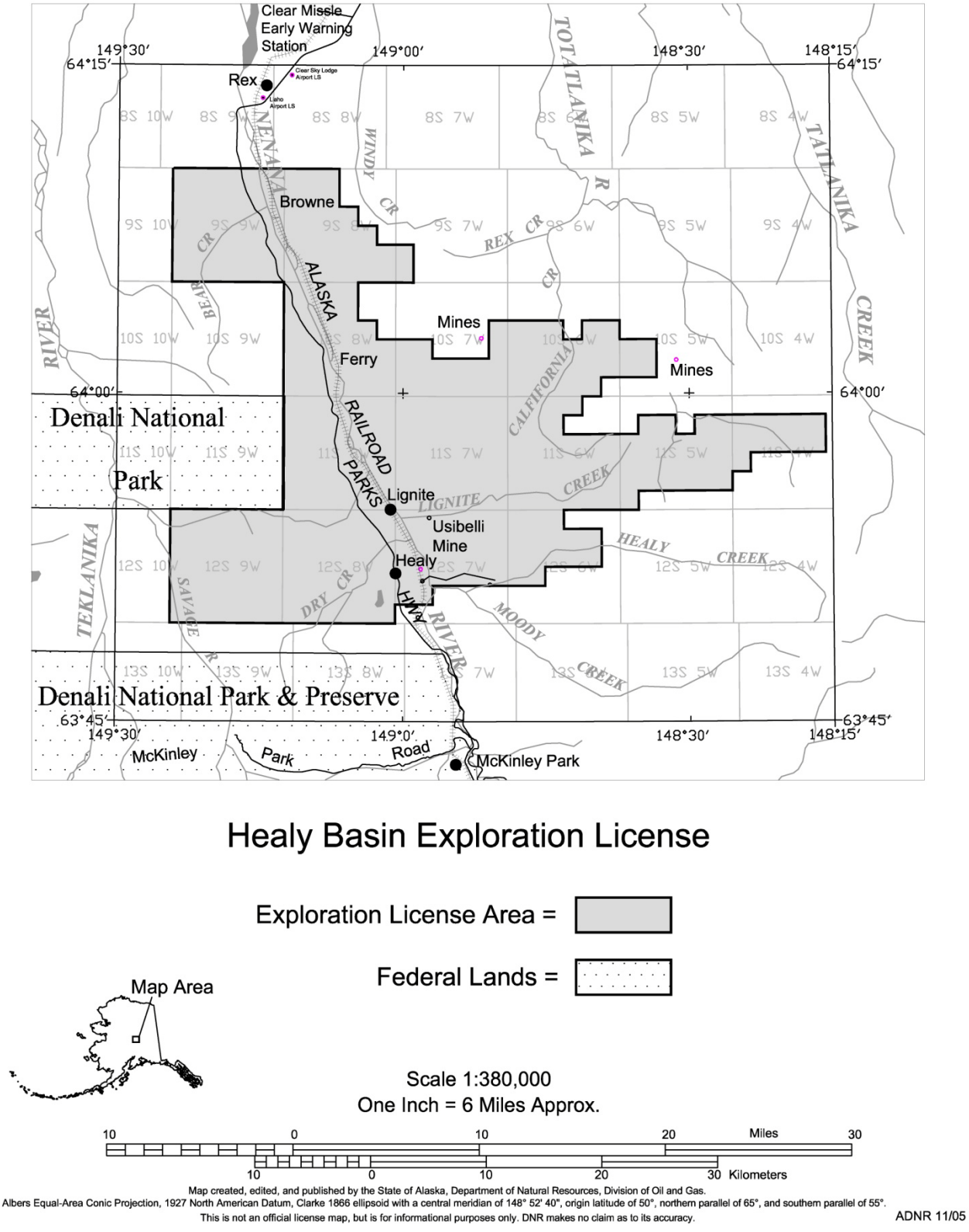
After weighing the facts and issues known to him at this time, considering applicable laws and regulations, and balancing the potential positive and negative effects given the mitigation measures and other regulatory protections, the director of the Department of Natural Resources, Division of Oil and Gas, has concluded that the potential benefits of issuing an exploration license outweigh the possible negative effects, and that issuing a gas-only exploration license to Usibelli Coal Mine, Inc. (UCM) will be in the best interests of the state of Alaska.

UCM, the applicant, proposed a work commitment of $500,000 over 10 years. UCM hopes to find and produce gas to power its mining operations; if larger quantities are discovered, it might be able to distribute gas to Southcentral utilities (Bluemink 2007).

The Healy Basin exploration license is for natural gas only, for both conventional and non-conventional natural gas. Natural gas is almost entirely methane; non-conventional natural gas is methane gas found in coalbeds. Coalbed methane accounts for more than 8% of natural gas production in the U.S. (NETL 2009). Most coalbeds are permeated with methane and a cubic foot of coal can contain 6 or 7 times the volume of natural gas that exists in a cubic foot of a conventional sandstone reservoir. Even though the geology of the Healy Basin suggests that gas, specifically coalbed methane, is the most likely resource present in economic quantities, there still exists a remote possibility of finding oil. If this were to occur, the licensee would have to shut down operations and contact DO&G.

DO&G issued a preliminary finding for the proposed exploration license on August 31, 2005. The next step in the licensing process is issuance of a final finding.

The commissioner of ADNR is required by AS 38.05.133(f) to determine whether an exploration license serves the state's best interests. The director of DO&G is delegated the responsibility to make that determination for the Healy Basin exploration license. This document presents the final finding for the issuance of a gas-only exploration license for the Healy Basin. The director reviewed all facts and issues known or made known to him and limited the scope of the finding to the license phase of gas activities and the reasonably foreseeable significant effects of issuing an exploration license (AS 38.05.133(f); AS 38.05.035(e)(1)(A)). Conditions for phasing have been met under AS 38.05.035(e)(1)(C). The content of a best interest finding is specified in AS 38.05.035(e), and topics that must be considered and discussed are prescribed in AS 38.05.035(g) and AS 38.05.133(f).



Healy Basin Exploration License

Exploration License Area =

Federal Lands =

Scale 1:380,000
One Inch = 6 Miles Approx.

10 0 10 20 Miles 30
10 0 10 20 30 Kilometers

Map created, edited, and published by the State of Alaska, Department of Natural Resources, Division of Oil and Gas.
Albers Equal-Area Conic Projection, 1927 North American Datum, Clarke 1866 ellipsoid with a central meridian of 148° 52' 40", origin latitude of 50°, northern parallel of 65°, and southern parallel of 55°.
This is not an official license map, but is for informational purposes only. DNR makes no claim as to its accuracy.

ADNR 11/05

Map 1.1. The Healy Basin exploration license area.

A. Exploration Licensing

The intent of licensing is to encourage exploration in areas far from existing infrastructure, with relatively low or unknown hydrocarbon potential, where there is a higher investment risk to the operator. A gas-only exploration license would give UCM the exclusive right to explore for gas without the initial expense of leasing bonuses. Through exploration licensing, the state receives valuable subsurface geologic information and, should development occur, revenue through royalties and taxes. Additionally, any reserves discovered could provide a source of energy for local consumption. Exploration licensing is discussed in further detail in Chapter Two.

Oil and gas activities – in this case, gas activities only – proceed in phases, with the activities of each subsequent phase dependent on the completion or initiation of the preceding phase. While the state holds oil and gas lease sales in established petroleum provinces, like Cook Inlet and the North Slope, a gas-only exploration license is the method to initiate gas exploration in other areas of the state. The exploration license phase is the first step in the process of developing the state's natural gas resources, subsequent to the director's affirmative best interest finding. A gas only exploration license grants the licensee the exclusive right to explore for gas and, provided the licensee meets certain conditions, to then convert all or a portion of the license to a gas lease. A gas lease grants to the lessee the exclusive right to drill for, extract, remove, clean, process, and dispose of natural gas. However, a plan of operations, subject to a myriad of regulatory authorities and permits, must be approved before any operations may be undertaken on or in the licensed or leased area. Oil and gas leases convey the rights to drill for both oil and gas, but a gas only lease is restricted to gas.

In the license phase, the licensee gathers information about the area's petroleum potential. This process may include examining surface geology, performing environmental assessments, conducting geophysical surveys, and drilling exploratory wells. If converted to a gas lease, further exploration may occur. During the development phase, operators evaluate the results of exploratory drilling and develop plans to bring the discovery into production. Production operations bring gas to the surface and prepare it for transport. Gas and associated substances may be held in subsurface storage.

B. Description of the Exploration License Area

The area under consideration surrounds the Parks Highway between approximately mile 248 and mile 300 (Map 1.1). The license area lies adjacent to or near Denali National Park and Preserve within the Denali Borough. This license may affect the communities of Healy, Anderson, Cantwell, Ferry, and McKinley Village. The Parks Highway and Alaska Railroad transect the western portion of the area. Additional information about the area and these communities is found in Chapter Three. The applicant has excluded lands whose mineral estate is owned by the Alaska Railroad Corporation, the University of Alaska, and the Alaska Mental Health Trust Authority.

C. Habitat, Fish, and Wildlife

The Healy Basin area includes terrestrial and freshwater habitats. Freshwater and anadromous fishes may be found in the area's waters. The area is seasonally inhabited by migratory birds. Terrestrial mammals inhabiting the area include caribou, moose, brown and black bears, Dall sheep, and furbearers. No known species using habitats in the area are listed on the federal endangered species list. Additional information on species and habitats of the area is found in Chapter Four.

D. Current and Projected Uses

Commercial guiding, hunting, trapping, recreation, and mining are the major land uses in the Tanana Basin. Traditional subsistence hunting , trapping, and fishing continue within the area. UCM mines coal near Healy and there are active mining claims in the area for gold and other minerals. Tourism

centers around Denali National Park and Preserve, which attracts visitors from around the world. These uses are discussed in more detail in Chapter Five.

E. Natural Gas in the Healy Region

ADNR has determined that the Healy Basin exploration license area has high potential for discovery of unconventional gas (coalbed methane or shallow gas) and a lower potential for discovery of deeper, conventional gas. The potential for oil is low. The area has all the geologic conditions favorable for a recoverable accumulation of coalbed methane, namely a significant volume of subbituminous C rank coal, as well as observed gas seeps. However, very little subsurface geological information is available. Phases of natural gas development included exploration, conversion of the license to a lease, development and production, and subsurface storage. The most likely method of transportation is by natural gas pipeline, which may include conversion to liquefied natural gas. Storage may occur in various ways and may include subsurface storage.

Petroleum potential, phases of natural gas development, and gas transportation are discussed further in Chapter Six.

F. Governmental Powers to Regulate Natural Gas

All exploration activities are subject to numerous federal, state, and local laws and regulations with which UCM is obligated to comply. These government agencies have a broad spectrum of authorities to regulate and condition activities related to natural gas; their roles in the oversight and regulation of gas activities differ, although some agencies may have overlapping authorities. These agencies include the Alaska Departments of Natural Resources, Environmental Conservation, and Fish and Game; the Alaska Oil and Gas Conservation Commission; the U.S. Environmental Protection Agency; the U.S. Army Corp of Engineers; the National Marine Fisheries Service, the U.S. Fish and Wildlife Service; and the Denali Borough. The Denali Borough has adopted regulations affecting the siting of facilities. Regulatory and statutory authorities are considered in Chapter Seven and Appendix B.

This a gas only license and the geology of the Healy Basin suggests that gas is the most likely resource present in economic quantities; however, there is a remote possibility of finding oil. If this were to occur, the licensee would have to shut down operations and contact DO&G.

G. Reasonably Foreseeable Cumulative Effects of Licensing and Subsequent Activity

Issuing a license alone is not expected to have any effects, other than to generate revenue to the state. Potential effects of activities subsequent to licensing can be both positive and negative. Most potentially negative effects on fish and wildlife species, habitats, and their uses; on local uses, residents, and property owners; and on local communities may be avoided, minimized, or mitigated through mitigation measures imposed on the exploration license. These measures are listed in Chapter Nine, along with licensee advisories. These provisions, along with other laws and regulations, apply to the license as well, and to a subsequent lease, if the license is converted to a gas only lease.

Mitigation measures are designed to specifically address or minimize unregulated, cumulative effects discussed below.

Water quality could be compromised if drilling muds, cuttings, and produced waters are improperly disposed. Drinking well aquifers, which many residents rely on for water, could be compromised or polluted if drilling wastes enter the water table.

Natural gas exploration, development, and production activities may produce emissions that have the potential to affect air quality, including carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter-10 (PM_{10}), $PM_{2.5}$, volatile organic compounds (VOC), ozone, and greenhouse gases including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Methane, a greenhouse gas, is the principal component of natural gas.

Potential post-license activities that could have cumulative effects on the area's habitats and fish and wildlife populations include seismic surveys, construction of support facilities, and drilling and production activities. Some potential cumulative effects of these activities include physical disturbances that could alter the landscape, lakes, rivers, and wetlands; habitat change; behavior changes of fish, wildlife and birds; drawdowns and contamination of groundwater; and contamination of terrestrial or freshwater habitats from discharges from well drilling and production, gas blowouts, or spills of hazardous substances.

Gas development could result in increased access to recreation, mining, hunting, and fishing areas due to construction of new roads, but this could also increase competition between user groups. Unregulated exploration and development could detract from the area's visual quality and attraction to tourists and could restrict local access to the area. However, increased access could benefit recreational and visitor uses by increasing the area available for those uses. Other potential benefits from gas development activity include a potential increase in wage earning opportunities to supplement subsistence activities.

If unregulated, natural gas activities subsequent to licensing could potentially affect local landowners and surface users, habitats, fish and wildlife, air quality, and subsistence, viewshed, recreational, sport, and commercial uses and users of the area's natural resources. Local residents' use of the area requires access to it; any activity, facility, or structure that restricts access could have an adverse impact on local residents, especially if private property is involved. Local access to the area may not be restricted, except immediately around facilities. However, measures included in this final best interest finding, along with laws and regulations imposed by state and federal agencies and the Denali Borough, are expected to avoid, minimize, and mitigate these potential effects.

More information about potential effects is found in Chapter Eight. Mitigation measures are found in Chapter Nine. Information about governmental powers to regulate natural gas exploration and development is found in Chapter Seven and Appendix B.

H. Fiscal Effects and Effects on the Denali Borough and Communities

Potential cumulative effects of natural gas exploration can be both positive and negative. Positive potential effects are job creation, a small initial contribution to state revenues, and the potential to use natural gas to lower energy costs. While the possibility of locating commercial quantities of natural gas are unknown, any revenue produced would help offset declining oil revenues. Licensees are encouraged to employ local and Alaska residents and contractors for work performed on the licensed area, to the extent they are available and qualified.

I. Mitigation Measures and Other Regulatory Protections

Mitigation measures address protection of private property; water quality and aquifers; air quality; facilities and operations; habitat, fish, and wildlife; commercial, and sport harvest activities; drilling muds, cuttings, and produced waters; potential spills of hazardous substances; access; prehistoric, historic, and archaeological sites; and local hire, and communication and training. Other regulatory requirements (licensee advisories) address other regulatory, permitting, or management authorities including the Alaska Departments of Natural Resources, Environmental Conservation, Fish and Game, and Labor and Workforce Development; U.S. Army Corps of Engineers, and U.S. Fish and

Wildlife Service; and the Denali Borough. Mitigation measures and licensee advisories are found in Chapter Nine. Information about governmental powers to regulate natural gas exploration and development is found in Chapter Seven and Appendix B.

J. Director's Final Finding and Signature

The director of the Division of Oil and Gas has made a final finding that, on balance, issuing a gas only exploration license to UCM is in the best interests of the state. AS 38.05.133(f) requires that, before a license is issued, the director determine whether the license is in the best interests of the state and, in conjunction with AS 38.05.035(e) and (g), also specifies what must be considered in making that determination.

This final finding is based upon a review of all facts and issues known, or made known, to the director. The director limited the scope of the finding to the exploration license phase of natural gas activities and the reasonably foreseeable significant effects of a license (AS 38.05.035(e)(1)(A)). Conditions for phasing were met under AS 38.05.035(e)(1)(C). At the licensing phase, the type, location, duration, timing, or level of any exploration or development activity that might subsequently occur cannot be predicted precisely. Therefore, the director has not considered possible specific effects of unknown future exploration, development, and production activities that are outside the scope of the finding. The effects of future exploration, development, production, and subsurface storage will be considered at each subsequent stage, when government agencies and the public review permit applications for the specific activities proposed at specific locations in the area. However, the director did consider, in general terms, the potential effects that may occur subsequent to licensing and leasing.

In making this final finding, the director considered and discussed the property descriptions and locations; the petroleum potential of the license area; the fish and wildlife species and their habitats; the current and projected uses in the area, including uses and value of fish and wildlife; the governmental powers to regulate natural gas exploration, development, production, and transportation; the reasonably foreseeable cumulative effects of gas exploration, development, production, and transportation on the license area, including effects on human uses, fish and wildlife habitats and populations and their uses, and historic and cultural resources; mitigation measures imposed on the license, including measures to prevent and mitigate release of hazardous substances, and a discussion of the protections offered by these measures; the methods most likely to be used to transport gas from the area and the advantages, disadvantages, and relative risks of each; the reasonably foreseeable fiscal effects of licensing and the subsequent activity on the state and affected municipalities and communities, including the explicit and implicit subsidies associated with the license; and the reasonably foreseeable effects of gas exploration, development, production, subsurface storage, and transportation on municipalities and communities within or adjacent to the license area (AS 38.05.035(g)).

Developing the state's natural gas resources provides a positive benefit to the state's economy and the well being of its citizens. In particular, the Healy Basin exploration license may provide significant positive economic benefits for the local economy. With the mitigation measures presented in this final finding imposed on licenses and plans of operation, as well as additional project-specific and site-specific mitigation measures that would be imposed in response to specific proposals, the natural gas resources of the license area can be explored and developed in a manner that avoids, minimizes, or mitigates potential effects on wildlife populations or human uses.

UCM must comply with all applicable local, state, and federal codes, statutes, and regulations. Licensee advisories notify UCM of other regulatory requirements, including those administered by the Alaska Departments of Natural Resources, Environmental Conservation, Fish and Game, and Labor and Workforce Development; the U.S. Army Corp of Engineers, and Fish and Wildlife

Service; and the Denali Borough. Additional project-specific and site-specific mitigation measures will be applied as appropriate to future authorizations. The state has sufficient authority through general constitutional, statutory, and regulatory empowerments; the exploration license; and plans of operation to ensure that UCM conducts its activities safely and in a manner that protects the integrity of the environment and maintains opportunities for existing and anticipated uses.

After weighing the facts and issues known at this time, considering applicable laws and regulations, and balancing the potential positive and negative effects given the mitigation measures and other regulatory protections, the director concludes that the potential benefits of the exploration license outweigh the possible negative effects, and that issuing the Healy Basin gas only exploration license to UCM will best serve the interests of the state of Alaska.

A person affected by this decision who provided timely written comments or oral testimony may request reconsideration, in accordance with 11 AAC 02. Any reconsideration request must be received by July 19, 2010, and may be mailed or delivered to:

Thomas E. Irwin, Commissioner
Department of Natural Resources
550 W. 7th Avenue, Suite 1400
Anchorage, Alaska 99501

Fax: 1-907-269-8918
Email: dnr.appeals@alaska.gov.

If reconsideration is not requested by that date or if the commissioner does not order reconsideration on his own motion, this decision goes into effect as a final order and decision on July 28, 2010. Failure of the commissioner to act on a request for reconsideration within 30 days after issuance of this decision is a denial of reconsideration and is a final administrative order and decision for purposes of an appeal to Superior Court. The decision may then be appealed to Superior Court within a further 30 days in accordance with the rules of the court, and to the extent permitted by applicable law. An eligible person must first request reconsideration of this decision in accordance with 11 AAC 02 before appealing this decision to Superior Court. A copy of 11 AAC 02 may be obtained from any regional information office of the Department of Natural Resources.

Kevin R. Banks, Director — June 28, 2010 Date

I concur with the director that issuing the Healy Basin gas only exploration license to UCM is in the state's best interest.

Thomas E. Irwin, Commissioner — June 28, 2010 Date

K. References

Bluemink, E.
2007 Battle brewing over methane drilling. Petroleum News. http://www.petroleumnews.com/pnads/167710543.shtml Accessed 4/1/2010.

NETL (National Energy Technology Laboratory)
2009 Future Supply and Emerging Resources, Coal Bed Natural gas. NETL - The Energy Lab. http://www.netl.doe.gov/technologies/oil-gas/FutureSupply/CoalBedNG/CoalBed_NG.html Accessed 6/8/2009.

Chapter Two: Introduction

Table of Contents

Page

List of Tables

Table Page

Chapter Two: Introduction

The Alaska Department of Natural Resources (ADNR), Division of Oil and Gas (DO&G) is offering a gas only exploration license to Usibelli Coal Mine (UCM) (see Map 1.1 in Chapter One). The exploration license area is within the Denali Borough, near Healy, and consists of 208,630 acres located within the Fairbanks Meridian. The exploration license grants the right to explore for gas only, not oil, and could subsequently be converted to a gas lease. The region's geology indicates that the likelihood of a discovery is greatest for natural gas. Of the two types of gas, conventional and non-conventional, the likelihood of a discovery of non-conventional gas (coalbed methane), found within coalbearing formations, is considered greater.

Alaska's assumed coal resources exceed 5.5 trillion short tons, nearly one-half of the United States total, and may contain over 1,000 trillion cubic feet (TCF) of methane gas. A cubic foot of coal may contain six or seven times the volume of natural gas that exists in a cubic foot of a conventional sandstone reservoir (NETL 2009). If only 10 percent of this assumed resource is recoverable statewide, it would triple the current proven conventional gas reserves for Alaska. The coal resource varies in rank from bituminous to lignite, and is formed in extensive Cretaceous to Tertiary aged basins throughout the state. Economically producible coalbed methane is an attractive alternative to diesel fuel, which is the main energy source for home heating and electrical power generation throughout much of rural Alaska.

A. Authorities

The Alaska Constitution provides that the state's policy is "to encourage…the development of its resources by making them available for maximum use consistent with the public interest" and that the "legislature shall provide for the utilization, development, and conservation of all natural resources belonging to the State…for the maximum benefit of its people" (Alaska Constitution, article VIII, §1 and 2). To comply with this provision, the legislature enacted Title 38 of the Alaska Statutes and directed ADNR to implement the statutes.

The legislature found that the people of Alaska have an interest in the development of the state's oil and gas resources to maximize the economic and physical recovery of the resources; maximize competition among parties seeking to explore and develop the resources; and maximize use of Alaska's human resources in the development of the resources (AS 38.05.180(a)(1)). The legislature also found that it is in the best interests of the state to encourage an assessment of its oil and gas resources and to allow the maximum flexibility in the methods of issuing leases and to offer acreage for oil and gas leases or for gas only leases (AS 38.05.180(a)(2).

B. Exploration Licensing

Exploration licensing (AS 38.05.131-134) supplements the state's conventional oil and gas leasing program by encouraging exploration in areas outside of known oil and gas provinces, such as the North Slope, Beaufort Sea, and Cook Inlet. The intent of licensing is to encourage exploration in areas far from existing infrastructure, with relatively low or unknown hydrocarbon potential, where there is a higher investment risk to the operator. Lease sales held in these higher-risk areas have attracted little participation, a deterrent being the bonus money a bidder must pay to win the lease. Exploration licensing gives an interested party the exclusive right to conduct oil and gas, or gas only, exploration without this initial expense. Through exploration licensing, the state receives valuable subsurface geologic information on these regions and, should development occur, revenue through royalties and taxes. Additionally, many of these areas of the state are more likely to yield gas rather than oil, and any reserves discovered could provide a source of energy for local consumption.

The licensing process is initiated in one of two ways:

- Each year during April, applicants may submit to the ADNR commissioner (commissioner) a proposal to conduct exploratory activity within an area they have specified; or
- The commissioner may, at any time, issue a notice requesting the submission of proposals to explore a designated area.

Any proposal received by the commissioner must designate how much money the licensee would spend on exploration (the work commitment) and the term (duration) of the license. The proposal need not describe the type of exploration activity the licensee will conduct. However, before any exploration activity can occur, the proposed activity must first go through required permitting processes. Within 30 days of receiving a proposal for an exploration license, the commissioner must either reject it in a written decision or give public notice of DO&G's intent to evaluate the acceptability of the proposal. The commissioner must also solicit comments on the proposal and request competing proposals per AS 38.05.133(d).

If the commissioner decides to evaluate the acceptability of a proposal, DO&G develops a preliminary finding to determine whether issuing a license is in the state's best interests. The public has 60 days to review and comment on the preliminary finding. If the director finds the proposal to be in the state's best interests, a final finding is developed and released. The final best interest finding must describe the license area, set the terms of the license, which may differ from an applicant's proposal, and list the conditions placed on the license area. Best interest findings, under AS 38.05.035(e)(7), must include a summary of agency and public comments regarding the disposal and DO&G's response. When there are no competing proposals, the finding must also identify the prospective licensee. If more than one proposal is submitted, the identity of each applicant is kept confidential, if so requested. If competing proposals are submitted and the finding concludes that issuing an exploration license would be in the best interests of the state, the successful licensee will be determined by a sealed bid process, with the license awarded to the applicant who has committed the most dollars to an exploration program. The applicant submitting the highest bid will be awarded the license (AS 38.05.133).

The recipient of a license must post a bond in the amount of the work commitment and pay a $1 per acre license fee. There are no additional charges during the term of the license, which can be up to 10 years.

If, by the fourth anniversary of the exploration license, the licensee has completed less than 25 percent of the total work commitment, the license will be terminated, with the remainder of the security forfeited to the state. If the licensee has completed less than 50 percent of the total work, then 25 percent of the licensed area will be relinquished, with an additional 10 percent relinquished each successive year until half of the original acreage has been relinquished.

There are significant differences between the leasing and licensing programs:

- Bids:
  - Leasing - prospective lessees submit a bonus bid based on dollars per acre, with the highest dollar per acre bid winning the lease. The money goes to the state.
  - Licensing - the prospective licensee proposes direct exploration expenditures for a specific area. This proposal is called a work commitment. The work commitment reflects the dollar amount that the prospective licensee will spend on exploration. The highest dollar amount will receive the license.

- Exploration Activity:
  - Leasing - the lessee is not bound to conduct any exploration on a lease. If a lessee does conduct exploratory activity, the lessee may initiate it at any time during the term of the lease.
  - Licensing - the licensee must spend at least 50 percent of the work commitment within four years or relinquish 25 percent of the license area to the state with an additional 10 percent being relinquished each successive year. If the licensee fails to spend at least 25 percent of the work commitment within four years, the license is terminated and the balance of the work commitment dollar amount is forfeited to the state. Therefore, exploration over some portion of the license area is highly likely.
- Payments:
  - Leasing - annual lease rentals begin when the lease is issued, starting at $1 per acre and increasing annually to a maximum of $3 per acre.
  - Licensing - the licensee pays a one-time, $1 per acre licensing fee. There is no rental income during the life of the license.

Once the work commitment has been met, i.e., exploration expenditures equal the amount of the winning bid, and if the licensee requests, the commissioner will convert all or a portion of the license area to standard oil and gas or gas only leases. A gas only exploration license may be converted to a gas lease only, not an oil and gas lease. Royalty rates on these leases must be at least 12.5%, and the annual rental rate is $3 per acre per AS 38.05.134[a].

C. Issues Addressed in Best Interest Findings ("g-list")

Alaska statutes govern the disposal of state-owned mineral interests. AS 38.05.035(e) states that upon a written finding that the interests of the state will be best served, the director may, with the consent of the ADNR commissioner approve contracts for the sale, lease, or disposal of available land, resources, property, or interests in them. The written finding is known as a best interest finding and describes the proposed license sale area, analyzes the potential effects of the license, describes measures to mitigate those effects, and constitutes the director's determination that the interests of the state will be best served by the disposal. DO&G makes available both a preliminary and a final written finding and provides opportunity for public comment. The final written finding also discusses material issues that were raised during the public comment period.

AS 38.05.035(e) and AS 38.05.133(f) prescribe what, at minimum, must be considered in a finding related to an exploration license. These items from AS 38.05.035(g) must be considered and discussed for a finding for a gas only exploration license:

i. property descriptions and locations;
ii. the petroleum potential of the license area, in general terms;
iii. fish and wildlife species and their habitats in the area;
iv. the current and projected uses in the area, including uses and value of fish and wildlife;
v. the governmental powers to regulate the exploration, development, production, and transportation of natural gas;
vi. the reasonably foreseeable cumulative effects of exploration, development, production, and transportation for natural gas on the license area, including effects on subsistence uses, fish and wildlife habitat and populations and their uses, and historic and cultural resources;

[a] A lower royalty rate and rental may be charged if certain conditions are met.

vii. license stipulations and mitigation measures, including any measures to prevent and mitigate releases of oil and hazardous substances, to be included in the license, and a discussion of the protections offered by these measures;
viii. the method or methods most likely to be used to transport oil or gas from the license sale area and the advantages, disadvantages, and relative risks of each;
ix. the reasonably foreseeable fiscal effects of the license and the subsequent activity on the state and affected municipalities and communities, including the explicit and implicit subsidies associated with the license sale, if any; and
x. the reasonably foreseeable effects of exploration, development, production, and transportation involving natural gas on municipalities and communities within or adjacent to the license sale area.

This document is organized for ease of reading and reviewing, and therefore does not necessarily follow the order of the "g-list". Location of "g-list" items are listed in Table 2.1.

Where there are no competing proposals, the finding must also identify the prospective licensee.

A compilation of other laws and regulations applicable to oil and gas activities in Alaska can be found in Appendix B.

Table 2.1. Location of topics required by AS 38.05.035(g)(1)(B) – "g-list" – and AS 38.05.133(f) in the best interest finding.

"g-list" Number	"g-list" Description	Location in Final Best Interest Finding
i	Property descriptions and locations	Chapter Three
ii	Petroleum potential	Chapter Six
iii	Fish, wildlife, and habitat	Chapter Four
iv	Current and projected uses; uses and value of fish and wildlife	Chapter Five
v	Governmental powers	Chapter Seven
vi	Reasonably foreseeable effects on subsistence; fish, wildlife, and habitat and their uses; and historic and cultural resources	Chapter Eight
vii	Mitigation measures	Chapter Nine
viii	Oil or gas transport	Chapter Six
ix	Reasonably foreseeable fiscal effects	Chapter Eight
x	Reasonably foreseeable effects on municipalities and communities	Chapter Eight

D. Process

The process of developing a best interest finding includes many opportunities for input, from a broad range of participants including public, government agencies, Native organizations, resource user groups, environmental organizations, and others.

1. Preliminary Best Interest Finding and Request for Public Comments

To obtain public comments on the preliminary best interest finding, DO&G follows the public notice statute, AS 38.05.945. This statute includes specific provisions for noticing best interest findings, as required under AS 38.05.035(e). These include: publication of both a legal notice and a notice in display advertising in newspapers of statewide circulation and in newspapers of general circulation in the vicinity of the proposed action; public service announcements on the electronic media serving the area to be affected by the proposed action; and one or more of the following methods: posting in a conspicuous location in the vicinity of the proposed action; notification of parties known or likely to be affected by the action; or another method calculated to reach affected parties. Notice must also be given to a municipality if the land is within the boundaries of the municipality; to a coordinating body or a community council if requested in writing; to a regional corporation if the boundaries of the corporation established by the Alaska Native Claims Settlement Act (ANCSA) encompass the land and the land is outside a municipality; to a village corporation organized under ANCSA if the land is within 25 miles of the village for which the corporation was established and the land is located outside of a municipality; to the postmaster of a permanent settlement of more than 25 persons located within 25 miles of the land if the land is located outside a municipality, with a request that the notice be posted in a conspicuous location; and to a nonprofit community organization or a governing body that has requested notification in writing and provided a map of its boundaries, if the land is within the boundaries.

In addition, AS 38.05.946 provides that a municipality, an ANCSA corporation, or nonprofit community organization may hold a hearing within 30 days after receipt of the notice, which the commissioner or his/her representative shall attend. The commissioner has discretion to hold a public hearing.

Public comment assists in providing a body of information for the best interest finding review and analysis that is as complete as possible. Information provided by agencies and the public assists the director in reviewing all of the facts and issues; determining which facts and issues are material to the decision of whether the proposed license is in the best interests of the state; and determining the reasonably foreseeable, significant effects of the proposed license.

2. Public Process for the 2005 Healy Basin Exploration License Preliminary Finding

On April 23, 2004, DO&G received an Exploration License Proposal for gas only exploration within the Healy Basin. On May 14, 2004, DO&G staff participated in a public meeting in Healy to discuss the status of the application. On November 9, 2004, DO&G issued a *Notice of Intent to Evaluate a Gas Only Exploration License Proposal and Request for Competing Proposals*. Because DO&G solicited competitive proposals, the division held confidential the name of the applicant submitting the exploration license proposal for this area and the provisions of their proposal. The division did not receive a competing proposal.

On January 11, 2005, DO&G issued a *Call for Comments* on the proposed exploration license, and the public was given 60 days in which to comment. The call for comments identified the applicant as Usibelli Coal Mine, Inc. and provided information on the proposal. DO&G staff attended a meeting

in the Healy region on January 19, 2005. During this meeting, DO&G staff presented information on the public process involved in evaluating an exploration license proposal, and on the technology and methods of gas exploration and production. DO&G conducted a public meeting in Healy on May 14, 2005.

DO&G issued a preliminary finding with a 60-day public comment period on August 31, 2005. During the comment period, the division conducted two public meetings. An informational meeting was held in Healy on September 21, 2005. A meeting to hear public comment on the preliminary finding was held in Healy on October 10, 2005. On October 31, 2005, the Denali Borough submitted a letter of comments reserving the right for future comments to DO&G.

On December 14, 2005, the Denali Borough Assembly introduced Draft Ordinances 05-20 and 05-21 for Coal Bed Methane Exploration and Development. The Assembly amended Draft Ordinance 05-20 in January of 2006, striking 6 of 30 sections. On January 19, 2006, UCM submitted a letter to the Denali Borough Mayor requesting a legal review by borough counsel of the draft ordinances.

After several versions of the draft ordinances, a legal review, and Denali Borough work sessions attended by UCM, DO&G, Alaska Mental Health Trust Lands Office, and Ahtna, Inc., the Assembly passed a revised Ordinance 5-21 on September 13, 2006. On the advice of counsel, the Assembly amended the ordinance, effectively removing the restrictions it imposed on gas exploration, on May 14, 2008. The Denali Borough currently requires that gas exploration facilities be set back from a recorded private property line (9 DBC 25.010). Drill pads must be set back 500 feet and compressor stations 1,500 feet. Variances are allowed if the operator obtains written consent of the landowner(s) adjoining the setback. Approval is also required from the Denali Borough. In addition, at least one public hearing must be held prior to securing a variance.

3. Final Best Interest Finding

After receiving public comments on the preliminary best interest finding, DO&G reviews all comments, revises the best interest finding as needed, and incorporates additional relevant information and issues brought up during the public comment period. The director strikes a balance of interests, determines if the proposed license is in the best interest of the state, and makes a final finding.

After the 60-day public comment period for the Healy exploration license ended, DO&G reviewed all written comments and oral testimony received. A response to comments is provided in Appendix A. Common issues and concerns raised among commenters included property values; tourism; water quality; air quality; local use of energy; noise; area west of the Nenana River; Denali National Park and Preserve and Wolf Townships; wildlife habitat fragmentation; and private property rights and bonding requirements.

After weighing the facts and issues known to him at this time, comments received during the public comment period, applicable laws and regulations, and balancing the potential positive and negative effects given the mitigation measures and other regulatory protections, the director has concluded that the potential benefits of issuing the Healy exploration license outweigh the possible negative effects, and that issuing the Healy exploration license will best serve the interests of the state of Alaska.

4. Request for Reconsideration and Appeal to Superior Court

A person who is eligible to file a request for reconsideration and who is aggrieved by the final written finding may, within 20 days after issuance of the final written finding, file a request for reconsideration of the decision by the commissioner (AS 38.05.035(i)). A person is eligible to file a request for reconsideration if the person "meaningfully participated" in the process set out for receipt of public comment and is affected by the final written finding. "Meaningfully participated" means

submitting written comment during the period for receipt of public comment or presenting oral testimony at a public hearing, if a public hearing was held (AS 38.05.035(i)).

A person may appeal a final written finding to the superior court, but only if the person was eligible to request, and did request, reconsideration of that finding. The points on appeal are limited to those presented to the commissioner in the person's request for reconsideration (AS 38.05.035(l)). By requiring a party to exhaust the administrative review and reconsideration process before appealing to the superior court, the agency is given full opportunity to review, analyze, and respond to concerns before litigation. For purposes of appeal, the burden is on the party seeking review to establish the invalidity of the finding (AS 38.05.035(m)).

E. Scope of Review

The director, in the written finding, shall establish the scope of the administrative review on which the director's determination that the disposal, such as this exploration license, will best serve the interests of the state is based, and the scope of the written finding supporting that determination. The scope of the administrative review and finding may address only reasonably foreseeable, significant effects of the uses proposed to be authorized by the disposal (AS 38.05.035(e)(1)(A)). For an effect to be "reasonably foreseeable": (1) there must be some cause/result connection between the proposed disposal and the effect to be evaluated; (2) there is a reasonable probability that the effect will occur as a result of the disposal; and (3) the effect will occur within a predictable time after the disposal. Therefore, the finding does not speculate about potential but improbable future effects, but instead reviews reasonably foreseeable effects of the disposal.

A reasonably foreseeable effect must also be "significant." Significant means a known and noticeable impact on or within a reasonable proximity to the area involved in the disposal.

Further, the director may limit the scope of an administrative review and finding for a proposed disposal to:

i. applicable statutes and regulations;

ii. the facts pertaining to the land, resources, or property, or interest in them, that the director finds are material to the determination and that are known to the director or knowledge of which is made available to the director during the administrative review; and

iii. issues that, based on the statutes and regulations, on the facts as described, and on the nature of the uses sought to be authorized by the disposal, the director finds are material to the determination of whether the proposed disposal will best serve the interests of the state (AS 38.05.035(e)(1)(B)).

Therefore, the scope of review in this final finding addresses the reasonably foreseeable, significant effects of the uses to be authorized by the exploration license and is limited to the applicable statutes and regulations, the material facts and issues known to the director that pertain to the license phase, and issues that the director finds are material to the determination of whether issuing the license will best serve the interests of the state. This includes consideration and discussion of facts that are material to issues raised during the period allowed for public comments, facts that are material to the matters listed in AS 38.05.035(g)(B)(i)-(xi), and the basis for the director's final finding, that, on balance, issuing the Healy exploration license would be in the state's best interest.

F. Phased Review

Phased review recognizes that the issuance of an exploration license for state land may result in future projects that cannot be predicted or planned with any certainty or specificity at the initial licensing stage and will require future detailed review for authorizations needed before commencement. In gas exploration licensing, neither the state nor the applicant(s) can determine

with any specificity at the licensing stage if, when, where, how, or what kind of production might ultimately occur. In addition, advances in technology may occur, market changes are unpredictable, and specific infrastructure requirements for possible production cannot be foreseen.

Phasing allows the analysis of proposed licensing to focus only on the issues pertaining to the licensing stage and the reasonably foreseeable, significant effects of licensing. Additional authorizations, such as plans of operation and permits, are required for exploration, development, and production phases. When a project is multiphased, review of issues that would require speculation about future factors may be deferred until permit authorization is sought at the exploration, development, and production phases.

A discussion of governmental and public involvement at these later phases can be found in Chapter Seven.

Under AS 38.05.035(e)(1)(C), the director may, if the project for which the proposed disposal is sought is a multiphased development, limit the scope of an administrative review and finding for the proposed disposal to the applicable statutes and regulations, facts, and issues identified above that pertain solely to the disposal phase of the project when:

i. the only uses to be authorized by the disposal are part of that phase;

ii. the disposal is a disposal of oil and gas, or of gas only, and, before the next phase of the project may proceed, public notice and the opportunity to comment are provided unless the project is subject to a consistency review under AS 46.40 and public notice and the opportunity to comment are provided under AS 46.40.096(c) [the Healy Basin area is not subject to AS 46.40 since it is located outside the state's coastal zone.];

iii. the department's approval is required before the next phase may proceed; and,

iv. the department describes its reasons for a decision to phase.

The conditions under which phasing may occur have been met in this final best interest finding for the Healy exploration license. Accordingly, the review of activities in the license area is of a multi-phased development. The director, in making this final finding, has limited the scope of the finding to the applicable statutes and regulations, facts, and issues that pertain solely to the exploration licensing phase of gas activities and the reasonably foreseeable significant effects of issuing an exploration license.

Condition (i) is met because the only uses authorized are part of the licensing phase. The license gives the licensee, subject to the provisions of the license, the exclusive right to conduct geological and geophysical exploration for gas within the licensed area and the exclusive right to drill for, extract, remove, clean, process, and dispose of any gas that may underlie the lands described by the license. While the license gives the licensee the right to conduct these activities, the license itself does not authorize any exploration or development activities by the licensee.

Condition (ii) is met because the license is for gas only, and before the next phase of the project may proceed, ADNR provides public notice and the opportunity to comment for proposed plans of operations in the license area.

Condition (iii) is met because ADNR's approval is required before the next phase (exploration) may proceed. Before exploration activities can occur on licensed lands, the licensee must secure all applicable permits and required bonding. Additional authorizations must also be secured from ADNR for any subsequent development or production phase.

The plans of operation must identify the specific measures, design criteria, construction methods, and standards that will be employed to meet the provisions of the license. Plans of operation are subject to extensive technical review by numerous local, state, and federal agencies. Gas exploration,

development, or production-related activities will be permitted only if proposed future operations comply with all local, state, and federal laws and the provisions of the license and subsequent lease.

Condition (iv) is met because ADNR describes above the reasons for its decision to phase.

Therefore, the scope of review in this finding is limited to the applicable statutes and regulations, the material facts and issues that are known to the director that pertain to the issuance phase, and the reasonably foreseeable, significant effects of licensing. This includes items required by AS 38.05.035(g)(i) through (x) (referred to as the "(g) list") and all material facts and issues expressed by the public during the public comment period. A discussion of the possible specific effects of unknown future exploration, development, and production activities is not within the scope of this final finding. The effects of future exploration, development, and production will be considered at each phase, when permit applications for specific proposed activities at specific locations are reviewed by various government agencies and the public. However, this final finding does discuss, in general terms, the potential effects that may occur with gas exploration, development, production, and transportation within the license area, and the mitigation measures to be imposed as terms of the license, as conversion lease provisions, and as plans of operation permit terms to avoid, minimize, or mitigate any possible adverse effects.

G. References

NETL (National Energy Technology Laboratory)

2009 Future Supply and Emerging Resources, Coal Bed Natural gas. NETL - The Energy Lab. http://www.netl.doe.gov/technologies/oil-gas/FutureSupply/CoalBedNG/CoalBed_NG.html Accessed 6/8/2009.

Chapter Three: Description of the Healy Basin Exploration License Area

Table of Contents

List of Tables

List of Figures

List of Maps

Chapter Three: Description of the Healy Basin Exploration License Area

A. Property Description

AS 38.05.035(g) directs that best interest findings provide a property description and location of the exploration license area. The license area contains approximately 208,630 acres entirely within the Denali Borough. The exploration license area may contain acreage in which the state owns both the land estate and the mineral estate; and acreage where the state owns just the mineral estate, while the land estate might be either privately owned or owned by a municipality. Only those free and unencumbered state-owned oil and gas mineral estates within the license area will be included in the license.

The western portion of the license area is bisected by the Nenana River, the area's principal river, as well as the Parks Highway and the Alaska Railroad. The area east of Healy is one of the most active mineral exploration and production areas in the state. There are large blocks of active claims and the entire area has very high potential for coal, gold, and other minerals (ADNR 1991).

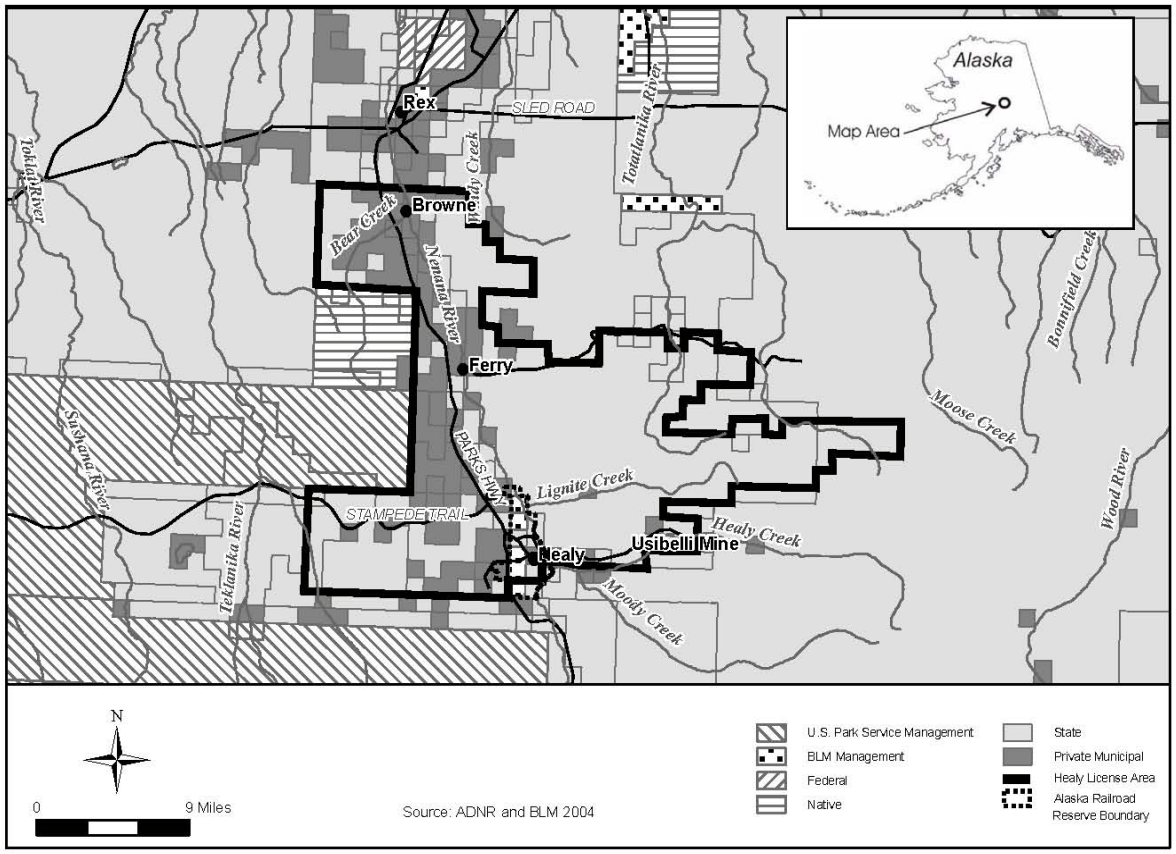
Land ownership within the area is a mixture of state, federal, and private holdings, including municipal (borough), University of Alaska, and Alaska Railroad lands (Map 3.1). Some lands adjoin Denali National Park and Preserve. The Alaska Mental Health Trust Authority owns lands in the area as well, and owns both the land and mineral estates. UCM has excluded from the license land owned by the Alaska Railroad, the University of Alaska, and the Alaska Mental Health Trust Authority.

B. Land and Mineral Ownership

In many areas of the United States, a land owner may hold an interest in both the land and mineral estates. This is especially true when the original owner was a settler or homesteader. The land and mineral estates may become separated when the original owner retains the land estate and sells (or leases) the mineral estate, or sells only the land estate and retains the mineral estate. Therefore, land and mineral interests may be retained by two separate entities.

Under United States common law, the mineral estate is the dominant estate and the land estate is the servient estate. However, the owner and/or lessee of a mineral interest must give "due regard" to the land estate owner during resource exploration and extraction. The land owner may be entitled to compensation for property damage or loss incurred during the exploration or extraction process.

The Alaska Statehood Act granted to the state of Alaska the right to select from the federal public domain 102.5 million acres of land to serve as an economic base for the new state. The Act also granted to Alaska the right to all minerals underlying these selections and specifically required the state to retain this mineral interest when conveying its interests in the land (AS 38.05.125). The Statehood Act specified that if Alaska disposed of its mineral rights contrary to the act, the state would forfeit the sub-surface mineral rights back to the federal government. Therefore, when state land is conveyed to an individual citizen, local government, or other entity, state law requires that the deed reserve the mineral rights for the state. Furthermore, state law reserves to the state the right to reasonable access to the surface for purposes of exploring for, developing and producing the reserved mineral. Surface owners are entitled to damages under AS 38.05.130, but may not deny reasonable access. Mineral closing orders, which are commonly associated with surface land disposals, do not apply to oil and gas leasing.



Map 3.1. Surface ownership in the Healy Basin exploration license area.

Under AS 38.05.125, licensees of oil and gas interests have the right to enter upon the surface estate for the purposes of exploration and development. However, a licensee of the subsurface must give "due regard" to the surface estate owner and may not enter the surface estate until the licensee makes a good faith effort to reach agreement with the surface estate owner on a settlement for damages that might be caused by license activities. If an agreement cannot be reached, the licensee may enter upon the land in exercise of the state's reserved rights only after posting a surety bond for an amount determined to be sufficient by the director of DO&G (AS 38.05.130). If converted to a lease, AS 38.05.180(gg) addresses bonding, setback, and noise mitigation requirements for the development of coalbed methane gas from a natural gas lease. The Denali Borough also requires that facilities be setback from a recorded private property line.

C. Historical Background

The earliest inhabitants of the region were nomadic Alaska Natives who fished, trapped, and hunted through the Interior. The first non-Native settlers were miners, who established a camp at Hoseanna Creek (later known as Lignite Creek) near Healy , prior to 1902. Mining has continued to support the region's economy, development, and settlement patterns.

Gold and coal resources in the area were originally identified and mapped as early as 1903-1911. Commercial coal production from the area has been continuous since 1916 and has produced an estimated 50 million tons from the area. Historic coal mining operations have occurred in the Healy

Creek, Lignite Creek, and Black Diamond (Otto Lake) areas. UCM has operated for over 60 years in the area and has over 37,000 acres of ADNR-issued coal leases in the license area. These include four permitted mine sites. Extensive infrastructure and facilities exist in support of these operations including numerous roads and trails, maintenance and office facilities, crushing and load-out facilities, and related power plants, power lines and interties, railroad lines and spurs.

Formation of the Denali National Park in 1917 and construction of the Alaska Railroad brought additional settlers to the area in the early 1920s. The Alaska Railroad was constructed from 1917 to 1923, and runs through the middle of the license area, paralleling the Nenana River and Healy Creek. The communities of Cantwell, McKinley Village, Healy, and Ferry were all originally railroad stops and communities. The railroad was owned by the federal government until 1985 when the state of Alaska purchased it and formed the Alaska Railroad Corporation. Clear Air Force Base, UCM, and tourism at the Denali Park have brought growth and development to the area.

D. Denali Borough and Local Communities

Communities within and near the license area are presented in Map 3.2.

1. Denali Borough

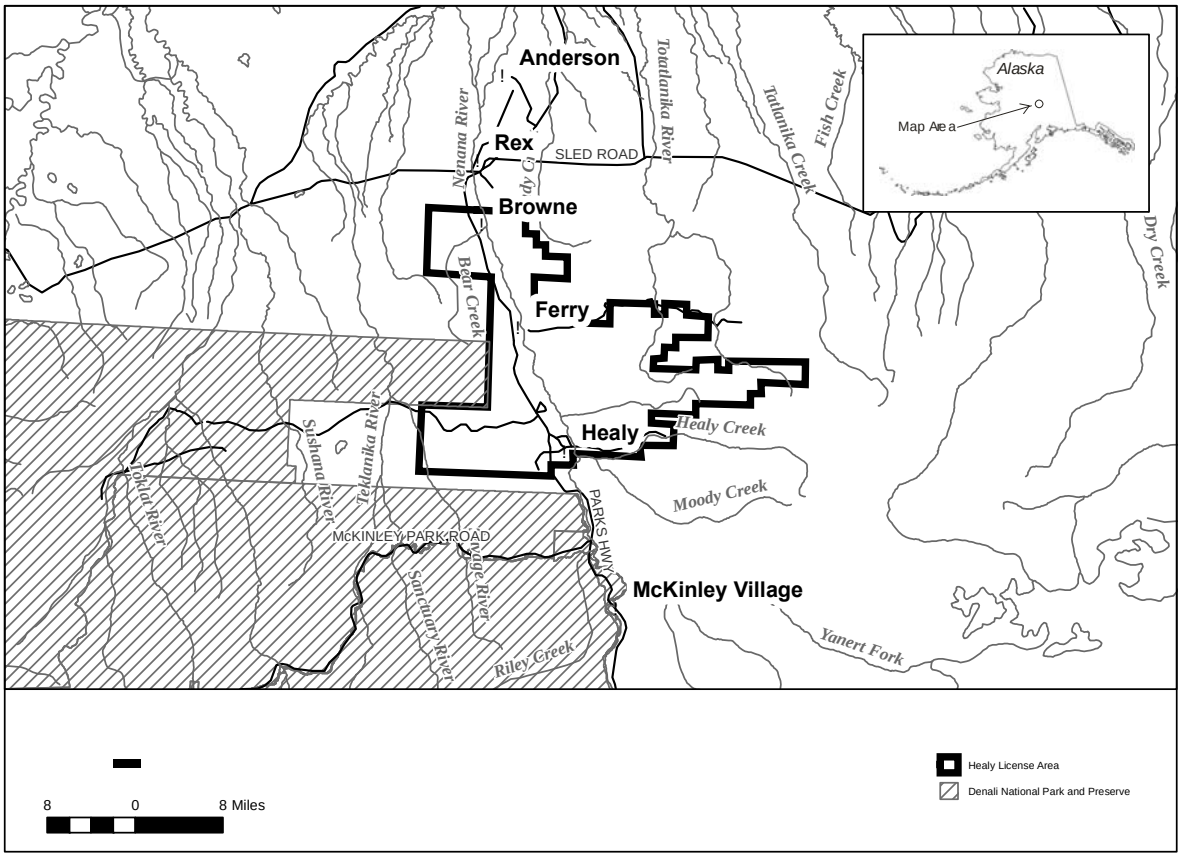
All of the license area falls within the Denali Borough, which is located in interior Alaska approximately 110 miles south of Fairbanks and 250 miles north of Anchorage. A home rule borough, it was incorporated in 1990, covers 8.2 million acres, and has a population of 1,848. Most residents live in the communities of Anderson, Cantwell, Healy, Ferry, and McKinley Village; about 138 people live in the borough outside of these communities (ADOL 2009). Nearly all residents live along the Parks Highway.

Borough services are funded through a bed tax ($1,922,905 in 2008) and a severance tax on gravel and coal ($55,567 in 2008) (ADOL 2009). There is no property or sales tax. Denali National Park covers approximately 70 percent of the borough, and serves as a major tourist attraction. The park had 432,309 visits in 2008, down from 458,308 in 2007 (NPS 2009). Seasonal non-resident workers triple the population each summer to support tourists drawn by the park and related tourism opportunities (ADOL 2009).

UCM, Clear Air Force Station, Golden Valley Electric Association, the Denali Borough School District, the National Park Service, and tourism-related industries and road services provide the majority of employment in the Denali Borough. UCM employs 100 year-round workers (ADOL 2009). Hotels, cabins, RV campgrounds, rafting guides, sightseeing, restaurants, and gift shops serve visitors. Nearly 40 percent of the summer employees in the area come from outside Alaska, and another 42 percent come from outside the borough.

The Alaska Department of Labor (ADOL) collects and reports employment data for jobs that are subject to employment regulation. Tourism in and adjacent to Denali National Park plays an important role in the local economy. The accommodation tax, a significant source of revenue for the borough, was raised in 1996 from 3 percent to 7 percent. Although the park is important to the local economy, jobs provided by UCM, Clear Air Force Station, and public service jobs provide stable employment to many of the year-round residents (Table 3.1).

Average annual unemployment rates are higher for the Denali Borough than for the state as a whole. Unemployment in 2008 ranged from a high of 15.7 percent in January to a low of 1.9 percent in August, with an annual average of 6.1 percent; 2009 started with an unemployment rate of 20.1 percent (ADOL 2009). In 2007, the average annual unemployment rate was 11.8 percent; the statewide average annual unemployment rate was 7.0 percent. However, average annual unemployment disguises seasonal variations that tend to be significant for the region (Figure 3.1). The unemployment rate dips well below the statewide average during the tourist season.



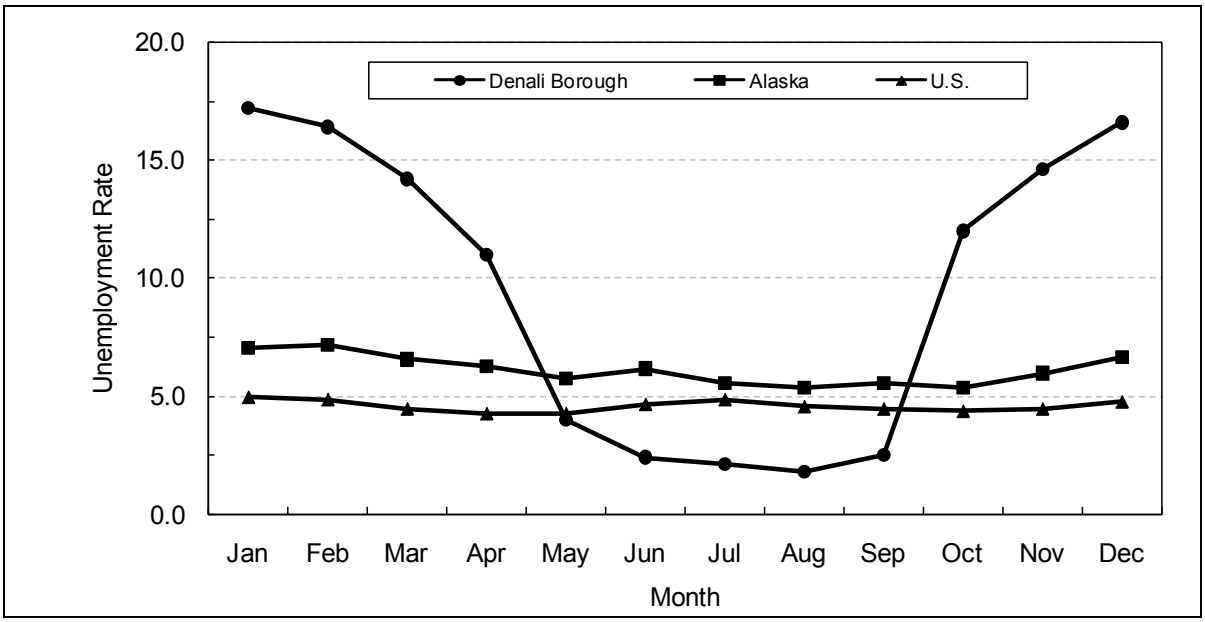
Source: ADNR and BLM 2004.

Map 3.2. Communities in the Healy Basin exploration license area.

Table 3.1. Average monthly employment in the Denali Borough, 2007.

Industry	Average Number of Workers per Month
Federal Government	210
State Government	22
Local Government	138
Natural Resources & Mining	101
Construction	21
Manufacturing	
Trade, Transportation & Utilities	484
Information Services	3
Professional & Business Services	189
Educational & Health Services	13
Leisure & Hospitality	1,052
Other Services	14

Source: ADOL 2009.



Source: ADOL 2009.

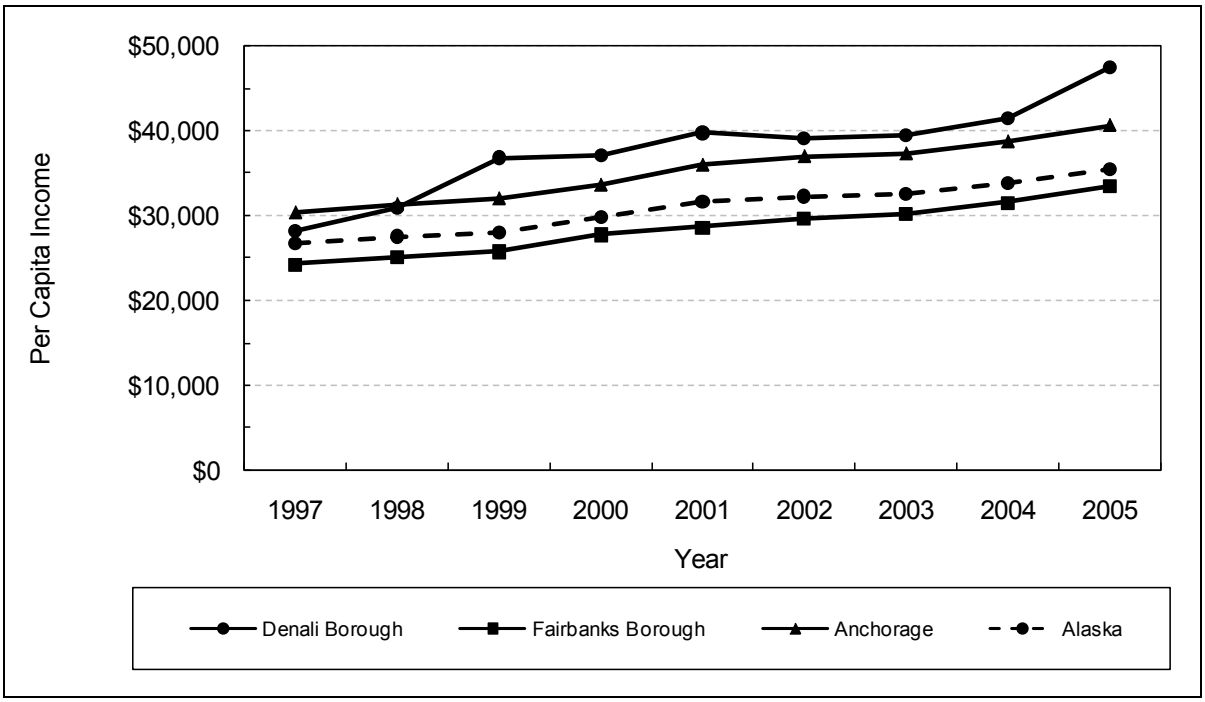
Figure 3.1 Average monthly unemployment rate, 2007.

The Denali Borough's per capita income has been higher than for the state and the nation since 1996 (ADOL 2008). Figure 3.2 compares the per capita incomes of the Denali and Fairbanks North Star boroughs, the state, and Anchorage from 1997 to 2005.

An extensive local power line grid is located in the license area and along the Nenana River corridor, including Golden Valley Electric Association's Healy Unit #1 Power Plant, the Healy to Fairbanks 138 kV Intertie (1967), the Willow to Healy 345 kV Intertie (1984), and the Northern 230 kV Intertie (2003). This includes electrification into large portions of Healy, Panguingue Creek Subdivision, and Ferry.

The $274 million Healy Clean Coal Power Plant was completed in November 1997, but has not been operated since 2000 because of a dispute with the Golden Valley Electric Association. In January 2009, the owner, Alaska Industrial Development and Export Authority (an independent state corporation), reached an agreement with Golden Valley Electric Association (GVEA) and Homer Electric Association (HEA) on the sale of the Healy Clean Coal Plant to GVEA (Golden Valley Electric Association 2009).

The majority of health services are provided by the Interior Community Health Center (ICHC), a qualified emergency care center in Healy. ICHC provides medical, dental, preventive, and educational health services (ICHC 2009). The Tri Valley Fire Department (TVFD) provides auxiliary health services, and is also based out of Healy. TVFD is the main responding ambulance service for the Denali National Park, and has personnel trained in swift water rescue, technical rope rescue, aeromedical transport, and wildland firefighting (TVFD 2009). The nearest hospital is located in Fairbanks. Specialized care available in the area includes Railbelt Mental Health and Addictions, and the Healy Senior Center.



Source: ADOL 2008.

Figure 3.2. Per capita income 1997-2005.

2. Anderson

Anderson, with a population of 295, is a second class city located on a spur road six miles west of the George Parks Highway, 76 miles southwest of Fairbanks and 285 miles north of Anchorage. The village was named for Arthur Anderson, a homesteader who settled in the area in the 1950s. In 1959, Mr. Anderson subdivided his 80-acre homestead into one-quarter acre lots, which were purchased primarily by civilian workers at Clear Air Force Station (AFS) (Anderson 2009).

The majority of Anderson's residents are military personnel or civilian employees of Clear AFS and their families. Employment opportunities are provided by the local school, Clear AFS, the city, or other government positions with subsistence activities also playing an important role in the community (Anderson 2009).

Most homes have individual wells, septic systems, and plumbing. Clear AFS provides water and sewer to all base facilities. Refuse is hauled to the new borough regional landfill 2 miles south of the community (ADCED 2009). In the 2000 census, 80 percent of households were heated using fuel oil or kerosene (ADCED 2009)

The George Parks Highway and the Alaska Railroad connect the city of Anderson with both Fairbanks and Anchorage. A state-owned 4,000 ft lighted asphalt airstrip is located at Clear Airport, four miles south of Anderson. Additionally, a private 2,500 ft dirt airstrip is located at Clear Sky Lodge (ADCED 2009).

3. Cantwell

Cantwell, with a population of 192, is an unincorporated community located on the George Parks Highway at the west end of the Denali Highway, 211 miles north of Anchorage. The Nenana River

was formerly named Cantwell River. The earliest inhabitants were nomadic Alaska Natives who trapped, hunted, and fished throughout Interior Alaska. The modern community began as a flagstop for the Alaska Railroad. There is one federally recognized tribe in the community, the Native Village of Cantwell (Denali Borough 2009).

The economy of Cantwell is based on highway tourism and transportation, as well as part-time seasonal construction work. One resident holds a commercial fishing permit, and subsistence hunting, gathering, trapping, and fishing are important to many residents.

The George Parks Highway connects Cantwell to both Fairbanks and Anchorage year round, while the Denali Highway provides access to the Richardson Highway in the summer months only. Cantwell is serviced by the Alaska Railroad, and the community contains one helipad, two privately owned airstrips, and one airstrip for public use (ADCED 2009).

Most homes and the school have individual water wells and septic systems and over 50 percent of households have complete plumbing. Refuse is deposited at a borough transfer station, then hauled to the new regional landfill near Anderson. In the 2000 census, 80 percent of households were heated using fuel oil or kerosene, with the others relying on wood heat (ADCED 2009).

4. Ferry

Ferry, with a population of 38, is an unincorporated community located 12 miles north of Healy, along both banks of the Nenana River. About 75 percent of the households in Ferry haul water and use outhouses or leachfields, the remainder use individual water wells and septic tanks. Thirty percent of the homes in Ferry are plumbed. The nearby community of Healy provides health care and employment opportunities for Ferry residents; there is no direct employment in Ferry.

Refuse is hauled to the new Borough regional landfill located just south of Anderson. In the 2000 census, about 57 percent of homes were heated with coal or coke.

Road access to the community of Ferry from the George Parks Highway is across land owned by the Alaska Railroad or by the University of Alaska. The majority of residents park in a private lot and cross the Nenana River by way of a railroad bridge and catwalk. Students are taken by ATV across the river to the school bus (ADCED 2009).

5. Healy

Healy, with a population 1,025, is an unincorporated community located at the mouth of Healy Creek on the Nenana River, 78 miles south of Fairbanks. Established in 1904, Healy lies on a 2.5 mile spur road just north of the entrance to Denali National Park and Preserve on the George Parks Highway.

The economy of Healy is diverse. UCM, which produces approximately 1.3 million tons of coal each year, is based in Healy. Though the coal mine dominates Healy's economy, tourism is becoming an important factor in the summer months. Tourism at nearby Denali Park supports local RV parks, guided rafting trips, helicopter tours, and other businesses. Golden Valley Electric Association and the Denali Borough School District are also major employers in Healy (Alaska.com 2009).

The Parks Highway was originally established from Fairbanks to Healy in the 1950s, with the final connection from Healy to Anchorage completed in the early 1970s. The Alaska Department of Transportation operates a maintenance station in Healy. The Healy Airport also lies adjacent to the Nenana River within this corridor and is used for commercial and private purposes.

The Panguingue Creek Subdivision was founded as the result of several different state land sales in the 1970s and 1980s, and the subdivision was designated as a settlement in the 1991 Tanana Basin

Area Plan. Surface ownership of the subdivision has since been conveyed to the Denali Borough and private owners.

The large majority of homes use individual wells and septic systems. Over 80 percent are fully plumbed. UCM and the Healy Clean Coal Plant have individual water well systems. Refuse is hauled to the new Borough regional landfill located just south of Anderson (ADCED 2009).

6. McKinley Village

McKinley Village, also known as McKinley Park Village, is an unincorporated community located at the entrance to Denali National Park and Preserve on the George Parks Highway. The population of McKinley Village is 160 people. The village developed around National Park Service employment and tourism-related facilities. McKinley Village is primarily a seasonal community; the population increases in the summer months to serve tourists, but few residents overwinter in the village (Denali Chamber of Commerce 2009).

Seasonal employment includes the headquarters for Denali National Park and Preserve; the Toklat Ranger Station; bus services; hotels; and guiding for trekking, rafting, horseback riding, recreation, and other tourism-related employment opportunities. Year-round employment opportunities for McKinley Village residents are provided by the nearby UCM, Golden Valley Electric Association, and the local school.

The George Parks Highway and the Alaska Railroad connect McKinley Village with both Fairbanks and Anchorage. Additionally, there are three airstrips within Denali National Park (ADCED 2009).

E. Historic and Cultural Resources

Historic and cultural resources can include a wide range of sites, deposits, structures, ruins, buildings, graves, artifacts, fossils, and other objects of antiquity. The Alaska Heritage Resources Survey (AHRS) is an inventory of all reported historic and prehistoric sites within the state of Alaska. Sites may be listed as historic if they are at least 50 years old (AHRS 2008). There are at least 92 known historic or prehistoric sites in the license area (AHRS 2008). It is very likely that there are additional sites that have not been documented.

F. Climate

The borough experiences a cold, continental climate. Temperatures range from -3 to 70 degrees Fahrenheit. The average annual precipitation is 12.7 inches, and average annual snowfall is 49.3 inches (ADCED 2009).

G. Geophysical Hazards

Natural conditions and processes may impose some constraints on exploration, production, and transportation activities associated with possible gas development. Proper siting, design, and construction practices should accommodate the potential natural hazards present in the license area.

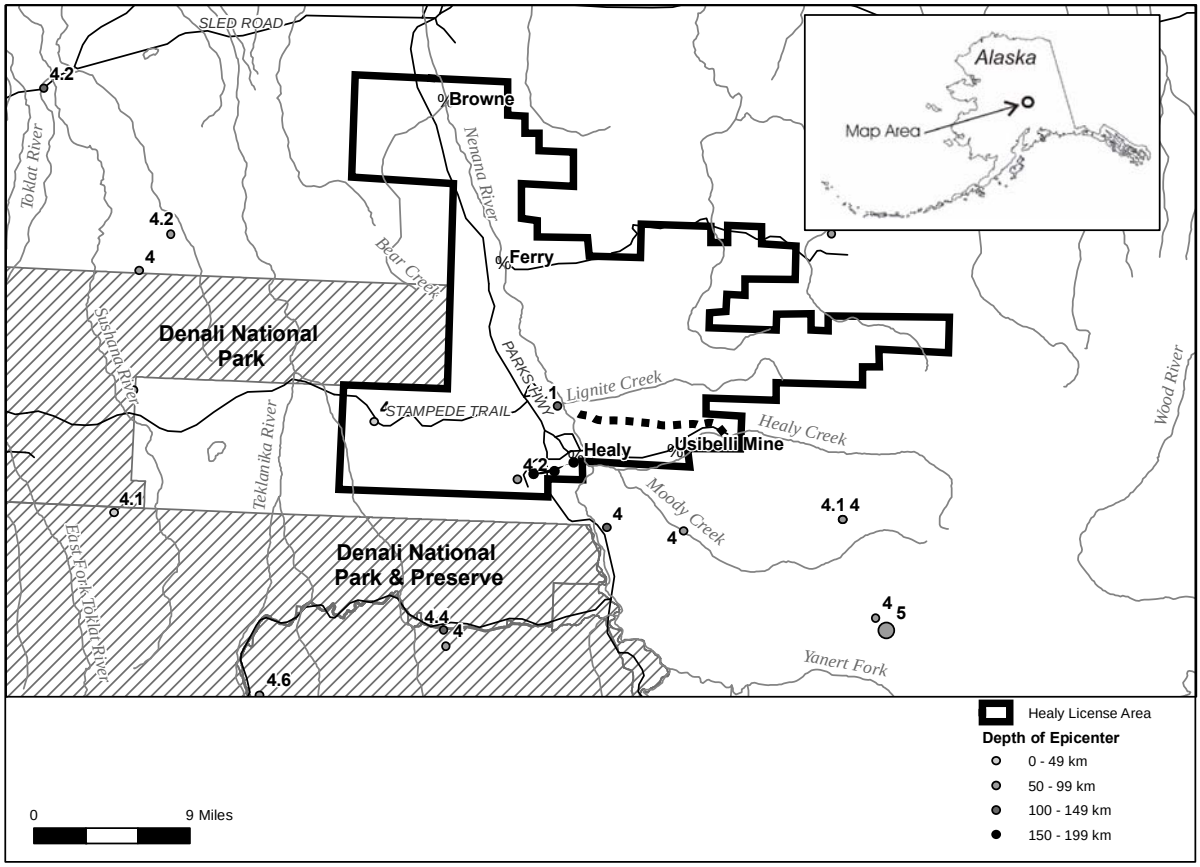
Development in the license area may be subject to potential geologic hazards including earthquakes associated with the Healy fault, volcanoes, floods, localized permafrost, and snow avalanches near steep terrain. Geologic maps show the distribution of bedrock and surficial deposits and faults in the region. Additional hazards may include localized snow avalanches and minor stream icings (Csejtey et al. 1992). The following is a brief summary of available information related to these hazards.

1. Earthquakes and Faulting

Two active faults are located within the license area: the Healy fault and the Healy Creek fault (Reger et al. 2003). The compilation of earthquake epicenters seen in Map 3.3 indicates a history of

relatively minor earthquakes reaching magnitudes as great as 4.2 in the license area. Earthquakes above magnitude 5.5 are considered to be potentially damaging. Twenty miles to the northeast of the license area, earthquakes as large as 7.2 have been recorded (AEIC 2009). Strong earthquakes may cause localized liquefaction features within the unconsolidated deposits of the Healy Basin. Other effects may include horizontal movement of vibration-mobilized soil, fissuring, and associated sand extrusions typical of areas where the ground surface is frozen.

The USGS has a series of seismic hazard maps for Alaska, which are available on the USGS Website at http://earthquake.usgs.gov/research/hazmaps/ . These maps depict earthquake hazard by showing, with contour values, the earthquake ground motions that have a given probability of being exceeded in 50 years. Based on historical earthquake occurrences and geological information on the recurrence rate of fault ruptures, the maps can be used to see the probabilistic ground motion for any location. The USGS seismic hazard maps are incorporated into the International Building Code for establishing the seismic design values for a selected location.



Source: AEIC 2009.

Map 3.3. Seismic history in the Healy Basin exploration license area, showing Healy Creek Fault (dashed line) and Healy Fault (dotted line).

2. Volcanoes

The license area is located over 300 miles from volcanoes in the Cook Inlet region. Alaska contains about 80 percent of all the active volcanoes in the United States and about 8 percent of the active volcanoes in the world. The western shore of Cook Inlet contains seven volcanoes that have erupted in Holocene time (10,000 years ago). These are, from north to south, Mt. Hayes, Mt. Spurr, Mt. Redoubt, Mt. Iliamna, Mt. St. Augustine, Mt. Douglas, and Fourpeaked Mountain (about 8 miles southwest of Mt. Douglas). Augustine last erupted with a series of explosive eruptions in January 2006, continuing with an effusive phase through late March. Fourpeaked had its first historic eruption on September 2007, with an ash plume to 20,000 feet asl (AVO 2008). Mt. Redoubt erupted most recently in March 2009 (AVO 2009).

The license area is far enough from the volcanic centers to be considered out of range of such proximal volcanic hazards as lava flows, block-and-ash flows, pyroclastic flows, hot gas surges, lahars (volcano-induced mudflows), and volcanogenic floods. Distal hazards are caused by volcanic eruptions that impact distant sites. The most common of these is ashfall, where explosive eruptions blast volcanic ash (finely ground volcanic rock) into the atmosphere and stratosphere and ash then drifts downwind and falls to the ground. There have been scores of such events from Cook Inlet and Alaska Peninsula volcanoes in the last century. In 1992, Mt. Spurr caused ash deposition of two millimeters as far north as Denali National Park and Preserve and (Waythomas and Nye 2002). Augustine's 1986 eruption sent continuous ash plumes as high as 4,600 meters (approximately 2.9 miles) and deposited ash as far north as the Brooks Range (Waythomas and Waitt 1998).

These ash clouds can drift thousands of kilometers from their source volcanoes and are a severe hazard to mechanical and electronic equipment such as computers, transformers, and engines if ash passes the air filter, causing electrical shorts and fusing jet engines. Fine ash is a nuisance and can cause respiratory problems, and heavy ashfall can disrupt activities by interfering with power generation and impairing visibility. Resuspension of dry ash by wind can cause the effects of ash fallout to persist well beyond the eruption.

Volcanic ashfall hazards from Cook Inlet volcanoes would be preceded by seismic activity received at monitoring stations maintained by the Alaska Volcano Observatory (AVO) on all of the Cook Inlet volcanoes except for Mt. Hayes. AVO distributes updates and warnings for volcanoes that exhibit signs of potential unrest in order to mitigate hazards to air traffic and receptors in surrounding areas. If a volcanic event occurs, the prevailing winds could move ash over the license area.

3. Flood Hazards

Flooding in the Healy area is commonly caused by either ice jams or high rainfall. Ice jam flooding occurs during spring breakup when ice blocks a river or stream, causing water to back up and flood adjacent land. Ice jam flooding is localized, but may affect a great number of people over time due to population concentration along rivers. High-rainfall floods can occur on any stream under the requisite meteorological conditions. In addition to hazards caused by high water levels, the primary hazards to facilities from river flooding are bank erosion, increased sediment deposition at the river mouth, high bed load transport, and channel modification.

Jökulhlaups are outburst floods of glacial origin; impounded waters break out of their basins and produce brief floods. Much of the damage associated with jökulhlaups comes from the large quantities of debris carried with the floodwaters. The Nenana River just north of Healy was identified by Reger et al. (2003) as an area prone to jökulhlaups. The study was conservative in assuming that a jökulhlaups would impact the entire downstream drainage, although bank storage may attenuate the rapid rise in water levels associated with such an event (Reger et al. 2003).

Stream icings (naleds or aufeis) are seasonal phenomena that develop where spring, surface, or seepage water flows over the surface during freezing temperatures and forms accretions of ice layers. The ice buildup gradually inundates facilities and other structures above the normal high-water mark of nearby streams. During the spring, increased stream flow due to snow melt may cause water to flow around the icing beyond the normal flood plain (Pewe 1982). Icings can present difficult engineering problems for the construction of bridges, roads, and other structures, and construction may exacerbate the conditions leading to icing development (Pewe 1982.). These hazards are highly localized, however, and can be mitigated by careful evaluation and avoidance of susceptible areas.

4. Permafrost

The license area is underlain by discontinuous permafrost. Permafrost is defined as soil, rock, or any other earth material whose temperature remains below freezing continuously for two or more years. Most of the permafrost in Alaska has been in existence for many thousands of years. The presence of permafrost depends upon the glacial and climatic history, the thermal properties of the local sediment and rock, and the insulating properties and thermal balance of material at the ground surface. The factors that control the distribution of permafrost also control its temperature, which varies markedly with depth, latitude, and geologic and topographic setting. Large, deep bodies of water (rivers, lakes, and oceans) also affect soil temperatures.

Only minor permafrost problems have been encountered in the license area. Melting of ice pockets in soil during the relatively warm summer months have resulted in localized slumps (Merritt 1985).

5. Snow Avalanches

Snow avalanches are sliding and turbulently flowing masses of snow, air, water, and debris capable of destroying people, structures, and property (Reger et al. 2003). Avalanche potential in the license area occurs in localized areas of steeper slope, typically ranging from 30 to 45 degrees.

6. Shallow Gas Deposits

Shallow gas deposits, such as those subject to this exploration license, may pose risks similar to overpressured sediments. Cook Inlet's Steelhead and Grayling platforms have experienced blowouts due to shallow gas. The same mechanisms for blow-out prevention and well control are employed to reduce the danger of loss of life or damage to the environment.

7. Mitigation Measures and Other Regulatory Protections

Several geologic hazards exist in the Healy area that could pose potential risks to gas installations. As discussed above, these potential hazards include earthquakes, volcanoes, flooding, permafrost, and snow avalanches.

The risks from earthquake damage can be minimized by siting facilities away from potentially active faults and unstable areas, and by designing them to meet or exceed national standards and International Building Code seismic specifications specific for Alaska. National industry standards help assure the safe design, construction, operation, maintenance, and repair of pipelines and other gas facilities. Sometimes referred to as "technical standards" they establish standard practices, methods, or procedures that have been evaluated, tested, and proven by analysis and/or application. These standards are intended to assure the safe design, construction, operation, maintenance, and repair of infrastructure. National consensus standards, such as the American Petroleum Institute (API), American Society of Mechanical Engineers (ASME), National Fire Protection Association (NFPA), and National Association of Corrosion Engineers (NACE), can carry the equivalent weight of law. In fact, many of them are codified by incorporation of all or parts of them into regulations by reference. They are constantly reviewed and upgraded by select committees of engineers and other technical experts (PHMSA 2008).

Site specific geotechnical studies should be conducted prior to any development activities to assess the local permafrost conditions, so the most cost-effective engineering modifications can be included during the design phase of the planned development. Permafrost problems can be avoided, minimized, or mitigated through proper siting, design, and construction considerations. Structures, such as drill rigs and permanent facility buildings, should be insulated to prevent heat loss into the substrate. Pipelines can be trenched, backfilled, insulated (if buried), or elevated to prevent undesirable thawing of permafrost.

Careful evaluation and avoidance of susceptible slopes can avoid, minimize, or mitigate potential hazards from snow avalanches.

All structures should be built to exceed minimum requirements of current applicable building codes, such as the Uniform Building Code or the International Building Code. Additional precautions should be taken to identify and accommodate special site-specific conditions such as unstable ground, flooding, erosion, and other localized hazards as well as noting locations susceptible to snow avalanches. Proper siting and engineering will minimize the potential effects of these natural processes.

Although geologic hazards could affect gas infrastructure, measures in this final best interest finding, along with regulations imposed by state, federal, and local agencies, in addition to design and construction standards discussed above, are expected to avoid, minimize, or mitigate those hazards. Mitigation measures address siting of facilities. A complete list of mitigation measures is found in Chapter Nine.

H. References

ADCED (Alaska Department of Community and Economic Development)
2009 Community Online Database. Alaska Department of Community and Economic Development. http://www.dced.state/ak.us/dca/commdb/CF_combdb.htm Accessed 1/2005 & 4/2009.

ADNR (Alaska Department of Natural Resources)
1991 Tanana Basin Area Plan for State Lands. ADNR, Fairbanks, AK.

ADNR and BLM (Alaska Department of Natural Resources; Bureau of Land Management)
2004 General land status coverage. Land Records Information Section, Anchorage, Alaska.

ADOL (Alaska Department of Labor and Workforce Development)
2008 Matanuska-Susitna Borough profile. Workforce Info, Alaska Economic Information System. http://www.commerce.state.ak.us/dca/AEIS/AEISMainFrame.cfm?CensusArea=Anchorage&Industry=General&IndexItem=DOL_Profile Accessed June 5, 2008.

ADOL (Alaska Department of Labor and Workforce Development)
2009 Workforce Info, Research and Analysis Home. http://almis.labor.state.ak.us Accessed 4/09.

AEIC (Alaska Earthquake Information Center)
2009 Interior Alaska seismicity. **http://www.aeic.alaska.edu/** Accessed April.

AHRS (Alaska Heritage Resources Survey)
2008 Alaska Heritage Resources Survey - general overview. Office of History and Archaeology. http://www.dnr.state.ak.us/parks/oha/ahrs/ahrs.htm Accessed May 29, 2008.

Alaska.com
2009 Healy, Alaska. http://www.alaska.com/places/cities/other_cities/story/2229.html Accessed 7/14/2009.

Anderson, C. o.
2009 City of Anderson, Alaska. http://www.anderson.govoffice.com/ Accessed 7/14/09.

AVO (Alaska Volcano Observatory)
2008 Alaska Volcano Observatory. U.S. Geological Survey and Geophysical Institute, University of Alaska Fairbanks. http://www.avo.alaska.edu Accessed 7/2008

AVO (Alaska Volcano Observatory)
2009 Alaska Volcano Observatory. U.S. Geological Survey and Geophysical Institute, Unversity of Alaska Fairbanks. http://www.avo.alaska.edu Accessed 4/2009.

Csejtey, B. J., M. W. Mullen, D. P. Cox and G. D. Stricker
1992 Geology and geochronology of the Healy Quadrangle, south-central Alaska. U.S. Geological Survey Miscellaneous Investigations 1961. http://www.dggs.dnr.state.ak.us/webpubs/usgs/i/text/i-1961.PDF

Denali Borough
2009 Cantwell, Alaska. http://cantwell.homestead.com/history.html Accessed 2009.

Denali Chamber of Commerce
2009 Visiting Denali. http://denalichamber.com/index.php Accessed 4/14/09.

Golden Valley Electric Association
2009 Healy Clean Coal Plant (HCCP). http://www.gvea.com/about/hccp/ Accessed 7-14-09.

ICHC (Interior Community Health Center)
2009 Interior Community Health Center. http://www.myhealthclinic.org/ Accessed 7/14/09.

Merritt, R. D.
1985 Field trip guidebook: Lignite Creek and Healy Coal Creek coal fields, Nenana Basin. Alaska Division of Geological & Geophysical Surveys Public Data File 85-19 58. www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=1112

NPS (National Park Service)
2009 NPS stats. National Park Service Public Use Statistics Office. http://www.nature.nps.gov.stats/viewReport.cfm Accessed 4/2/09.

Pewe, T. L.
1982 Geologic hazards of the Fairbanks area. Alaska Division of Geological & Geophysical Surveys, Special Report 15. www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=2614

PHMSA (Pipeline and Hazardous Materials Safety Administration)
2008 Pipeline and Hazardous Materials Safety Administration. U.S. Department of Transportation. http://phmsa.dot.gov/pipeline/about Accessed August 28, 2008.

Reger, D. R., D.S.P, D. R. C. Stevens and H. R. Livingston
2003 Survey of geology, geologic materials, and geologic hazards in proposed access corridors in Alaska. Alaska Division of Geological & Geophysical Surveys, Miscellaneous Publication 129. www.dggs.dnr.state.ak.us/pubs/pubs?reqtype=citation&ID=2946

TVFD (Tri-Valley Volunteer Fire Department)
2009 Tri-Valley Volunteer Fire Department. http://www.trivalleyfire.org/ Accessed 7/14/09.

Waythomas, C. F. and C. J. Nye
2002 Preliminary volcano-hazard assessment for Mount Spurr Volcano, Alaska. U.S. Geological Survey Open-File Report OF 01-0482, Anchorage, AK. http://www.avo.alaska.edu/pdfs/of01-482.pdf

Waythomas, C. F. and R. B. Waitt
1998 Preliminary volcano-hazard assessment for Augustine Volcano, Alaska. U.S. Geological Survey Open-File Report OF 98-0106 Anchorage, AK. http://www.avo.alaska.edu/pdfs/augustine_ofr.pdf

Chapter Four: Habitat, Fish, and Wildlife

Table of Contents

List of Tables

List of Maps

Chapter Four: Habitat, Fish, and Wildlife

The Healy Basin area supports a broad variety of habitats which are home to a diverse population of fish and wildlife species. These habitats and species provide important economic, recreational, and subsistence activities for residents and visitors to the area. Currently, there are no threatened or endangered plant or animal species found within the license area.

Numerous environmental baseline studies have been conducted for UCM surface mining permits. These permits contain extensive public information on pre-mining soils, ground water, surface water, vegetation, wildlife, archeological resources. and cover significant portions of the license area. Additionally, an Environmental Impact Statement (EIS) was completed in 1993 for the Healy Clean Coal Project (USDOE 1993), as well as a federal EIS issued in 1998 (BLM 1998). Significant information on the license area is also contained within the best interest finding for the 1999 Golden Valley Electric Association's Northern Intertie project and the Tanana Basin area plan, which is currently under revision (ADNR 1991). This information should be considered in future permitting.

A. Habitat

1. Vegetation

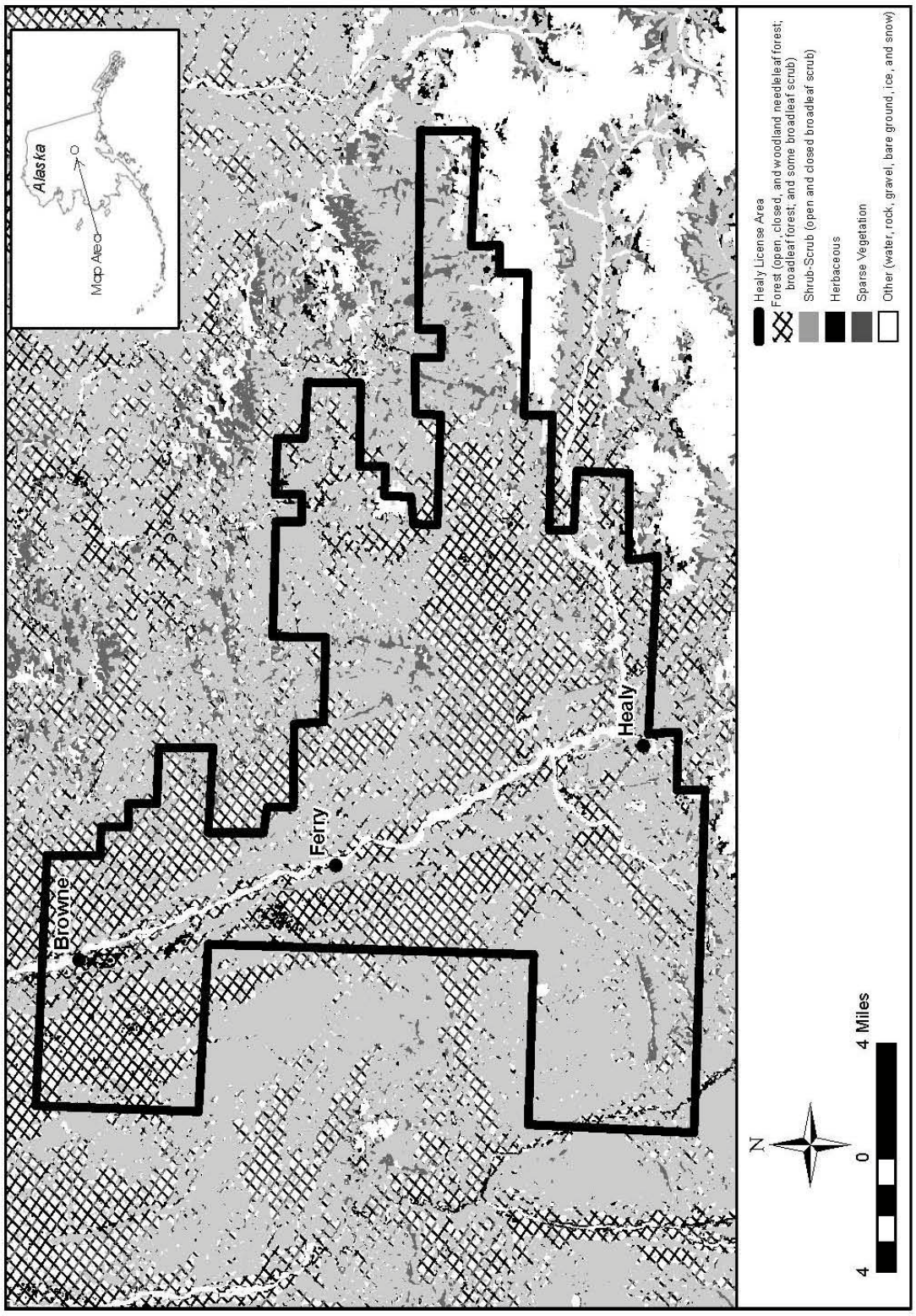
The Healy Basin falls between two ecoregions: the Alaska Range, dominated by shrub communities and alpine tundra; and the Tanana-Kuskokwim Lowlands, which are dominated by boreal forests (Nowacki et al. 2001). Land cover data were obtained from Landsat imagery (Winterberger 1984). The original raster received was modified to create a map of the general distribution of habitat types depicted on Map 4.1. The unmodified raster (Winterberger 1984) was used to divide the vegetation into categories based on the Alaska Vegetation Classification (Viereck et al. 1992; Table 4.1).

The Healy Basin provides excellent habitat for many species of furbearers including red fox, otter, marten, wolverine, lynx, and beaver (ADNR 1991). The Tanana Basin Area Plan (ADNR 1991) identifies several areas within the Healy Basin that are critical habitat for Dall sheep. Critical habitat areas are defined as necessary for the perpetuation of a species, and within the license area include the high mountain areas in Management Subunits 4D1, 4D3, and 4P2. These smaller area, subunits, contain sheep winter range, lambing cliffs, and mineral licks (ADNR 1991).

During the summer, caribou are typically found in treeless uplands consisting of heath tundra, alpine tundra, and sedge wetland associations. Feeding activity is concentrated in the sedge (*Carex spp.*) dominated wetlands. In addition to sedges, many grasses, forbs, and horsetails are consumed, as well as leaves of willows (*Salix spp.*), resin birch (*Betula glandulosa*), and dwarf birch (*Betula nana*). Windswept ridges, lingering snow drifts, and elevated terrain are additional habitats used by caribou for the purpose of insect avoidance (ADF&G 1986b). Winter habitat for caribou includes spruce forests, bogs, and lake shores.

Fruticose lichens, typically found in spruce/lichen associations, as well as sedges and grasses are dominant food species used. Willows, horsetails, and dwarf shrubs are used to a lesser extent, though still potentially nutritionally significant.

Helm (1985) performed a detailed investigation of plant communities in the Healy area in the Poker Flats permit area of UCM. The study area encompassed Poker Flats, areas north of Hoseanna (Lignite) Creek, and within the Lignite Creek floodplain. Major vegetation types are described below, though local species composition may vary. The species list generated from this study (Helm 1985) is provided in Table 4.2.



Source: Winterberger 1984

Map 4.1. Vegetation types in the Healy exploration license area.

Table 4.1. Vegetation types and amounts in the Healy exploration license area.

Vegetation Type	Acres
Needleleaf Forest	8,800
Needleleaf Woodland	45,047
Broadleaf Forest	52,814
Broadleaf Shrub - Closed	3,553
Broadleaf Shrub - Open	106,626
Herbaceous - Wet	3,926
Sparse vegetation	12,273
Rock and Gravel	304
Other (including no data)	12,672

Source: Winterberger 1984.

Open black spruce forest types were found in several types of sites, covering a range of drainage classes and successional status. Total vascular vegetation cover for open black spruce forests was 86%, with the following percent cover by layer: trees 36%, tall shrubs 5%, low and dwarf shrubs 67%, forbs 3%, graminoids 8%, and the ground layer 97% cover. Dominant vascular species included black spruce, bog blueberry, lowbush cranberry, and Labrador tea.

Open mixed paper birch – spruce forest occupied a variety of sites. Total vascular vegetation cover for open mixed paper birch - spruce forests was 89%, with the following percent cover by layer: trees 40%, tall shrubs 10%, low and dwarf shrubs 64%, forbs 9%, graminoids 1%, and the ground layer 96% cover. Dominant tree species in this vegetation type were paper birch and white spruce, though black spruce were observed in most stands. Dominant shrubs include bog blueberry, lowbush cranberry, and Labrador tea.

Closed birch forest types occurred within the study area along Runaway Ridge, either intermixed with closed alder shrubland or at a slightly higher elevation. Total vascular vegetation cover for closed birch forests was 98%, with the following percent cover by layer: trees 67%, tall shrubs 36%, low and dwarf shrubs 29%, forbs 20%, graminoids 24%, and the ground layer 100% cover. Dominant species were paper birch, Sitka alder, bog blueberry, and bluejoint.

Closed aspen forest types had a total vascular vegetation cover of 94%, with the following percent cover by layer: trees 60%, low and dwarf shrubs 74%, forbs 31%, and the ground layer 100% cover. Dominant species in this vegetation type were quaking aspen, bog blueberry, lowbush cranberry, crowberry, and bunchberry.

Closed alder shrubland types had a total vascular vegetation cover of 99%, with the following percent cover by layer: trees 5%, tall shrubs 94%, low and dwarf shrubs 10%, forbs 11%, graminoids 53%, and the ground layer 100% cover. Dominant species were Sitka alder and bluejoint.

Open alder shrubland types had a total vascular vegetation cover of 98%, with the following percent cover by layer: trees 8%, tall shrubs 20%, low and dwarf shrubs 74%, forbs 8%, graminoids 31%, and the ground layer 100%. Dominant species in this vegetation type were Sitka alder, resin birch, bog blueberry, lowbush cranberry, Labrador tea, and bluejoint.

Ericaceous shrub tundra types had a total vascular vegetation cover of 82%, with the following percent cover by layer: trees 3%, tall shrubs 2%, low and dwarf shrubs 75%, forbs 3%, graminoids

8%, and the ground layer 94%. Dominant species in this vegetation type were bog blueberry, lowbush cranberry, and Labrador tea.

Bluejoint meadow types had a total vascular vegetation cover of 85%, with the following percent cover by layer: low and dwarf shrubs 2%, forbs 10%, graminoids 84%, and the ground layer 97%. The dominant species in this vegetation type was bluejoint.

Woodland white spruce types had a total vascular vegetation cover of 99%, with the following percent cover by layer: trees 14%, tall shrubs 1%, low and dwarf shrubs 97%, forbs 2%, and the ground layer 99%. Dominant species in this vegetation type were white spruce, bog blueberry, lowbush cranberry, Labrador tea, and resin birch.

2. Wetlands and Aquatic Plants

Wetlands are defined by the U.S. Army Corps of Engineers as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3(b)).

Plants require special adaptations to survive life under the saturated or anaerobic conditions found in wetlands. The U.S. Fish and Wildlife Service (USFWS) has published a list of plant species for Alaska (USFWS 1988; USDA 2009) that assigns an indicator status showing the relative probability of the occurrence of each species in wetlands. Plants are categorized as obligate (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU), upland (UPL), drawdown (DRA), not listed (NL), or not yet assigned an indicator status (NI). Species with indicator status of OBL, FACW, or FAC are considered adapted for life in saturated or anaerobic soil conditions. Such species are referred to as "hydrophytic" vegetation, or "hydrophytes."

Obligate plant species (OBL), are defined as always found in wetlands under natural (not planted) conditions (frequency greater than 99%), but may persist in non-wetlands if planted there by man or in wetlands that have been drained, filled, or otherwise transformed into non-wetlands.

Facultative wetland plant species (FACW), are usually found in wetlands (34% - 66% frequency), but occasionally found in non-wetlands.

Facultative plant species (FAC), are sometimes found in wetlands (34% - 66% frequency), but also occurs in non-wetlands.

Facultative upland plant species (FACU), are seldom found in wetlands (1% - 33% frequency), and usually occurs in non-wetlands.

Upland plant species (UPL), occur in wetlands in another region, but are not found (<1% frequency) in wetlands in the region specified (Alaska). If a species does not occur in wetlands in any region, it is not on the list.

Drawdown plant species (DRA), are typically associated with the drier stages of wetlands, such as mud flats, vernal pools, and playa lakes.

Table 4.2. Plant species within or adjacent to the Healy exploration license area.

Scientific Name	Common Name	Scientific Name	Common Name
Equisetum arvense	Meadow horsetail	*Oxycoccus microcarpus*	Swamp cranberry
Equisetum pratense	Meadow horsetail	*Vaccinium uliginosum*	Bog blueberry
Lycopodium annontinum	Stiff clubmoss	*Vaccinium vitis-idaea*	Mountain cranberry
Lycopodium selago	Fir clubmoss	*Corydalis sempervirens*	Pink corydalis
Picea glauca	White spruce	*Gentiana propinqua*	Gentian
Picea mariana	Black spruce	*Lupinus arcticus*	Arctic lupine
Carex spp.	Sedges	*Epilobium angustifolium*	Fireweed
Eriophorum vaginatum	Tussock cottongrass	*Boschniakia rossica*	Poque
Eriophorum spp.	Cottongrass	*Polemonium acutiflorum*	Jacob's ladder
Agrostis scabra	Hair grass	*Polygonum alaskanum*	Wild rhubarb
Calamagrostis canadensis	Bluejoint	*Trientalis europaea*	Arctic starflower
Festuca altaica	Fescue grass	*Pyrola asarifolia*	Liverleaf wintergreen
Hierochloe alpina	Alpine holygrass	*Aconitum delphinifolium*	Monkshood
Iris setosa	Wild iris	*Rosa acicularis*	Prickly rose
Tofieldia coccinea	Northern asphodel	*Rubus arcticus*	Nagoon berry
Alnus sinuata	Sitka alder	*Rubus chamaemorus*	Cloudberry
Betula glandulosa	Resin birch	*Rubus idaeus*	Raspberry
Betula papyrifera	Paper birch	*Sanguisorba stipulata*	Sitka burnet
Mertensia paniculata	Tall bluebell	*Spirea beauverdiana*	Beauverd spirea
Linnaea borealis	Twin flower	*Populus balsamifera*	Balsam poplar
Viburnum edule	High-bush cranberry	*Populus tremuloides*	Quaking aspen
Artemisia tilesii	Wormwood	*Salix alaxensis*	Feltleaf willow
Petastites alaskanus	Coltsfoot	*Salix monticola* Bebb	Park's willow
Solidago multiradiata	Goldenrod	*Salix planifolia*	Diamondleaf willow
Cornus canadensis	Bunchberry	*Salix* spp.	Willow
Empetrum nigrum	Crowberry	*Geocaulon lividum*	Sandalwood
Andromeda polifolia	Bog rosemary	*Parnasia* spp.	Grass-of-parnassus
Arctostaphylos alpina	Alpine bearberry	*Ribes triste*	American red currant
Ledum groenlandicum	Labrador tea	*Pedicularis labradorica*	Labrador lousewort

Source: Helm 1985.

Wetlands within the Healy Basin have been mapped by the USFWS National Wetlands Inventory (NWI), which provides classification based upon ecological characteristics (Cowardin et al. 1979). Wetland types within the Healy Basin include both palustrine and riverine wetlands. Palustrine wetlands are freshwater wetlands dominated by either woody or emergent vegetation, as well as ponds less than 20 acres in size. Riverine wetlands are contained within river or stream channels. No marine, estuarine, or lacustrine wetlands, deep water habitats greater than 20 acres in size or 7 feet in depth, are present within the license area.

The Cowardin classification is a hierarchical system. Wetlands are first split into systems, or groups with common hydrologic, geomorphologic, chemical, or geologic factors (*e.g.* marine, estuarine, riverine, lacustrine and palustrine systems). With the exception of palustrine systems, each system is then broken down into a more specific subsystem (*e.g.* estuarine subtidal, riverine lower perennial). Wetlands are then broken down to class, subclass, and dominance type. Class describes the general appearance of the habitat, either in terms of vegetation or physiography and composition of the

substrate (*e.g.* palustrine scrub shrub, estuarine subtidal rock bottom). Subclass provides greater detail for the vegetation or substrate described in class. For example, a palustrine (system) scrub-shrub (class) wetland can be further broken down into the subclasses broad-leaved deciduous, needle-leaved deciduous, broad-leaved evergreen, needle-leaved evergreen, or dead. The dominance type details the dominant species in the habitat.

A small portion of the license area has been delineated following the procedures described in the *U.S. Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) (Roth et al. 1997). The most common wetland type delineated in the Healy area was a scrub-shrub lowland, corresponding to Cowardin types PSS4B/PEM1B, PSS1B/PEM1B, PSS1B, PSS1E, PSS4B, PSSS4/1B, and PSS4/2B. Table 4.3 provides definitions for the Cowardin types present in the license area.

This wetland type was found in depressions on hilltops, on gentle slopes, valley bottoms, and flatlands. Vegetation typically consisted of open and closed stands of shrub birch (*Betula spp.,* FACU-FAC*)*, black spruce (*Picea mariana,* FACW), and tamaracks (*Larix larcina,* FACW) with diamond-leaf willow (*Salix pulchra,* FACW), bog blueberry (*Vaccinium uliginosum,* FAC), mountain cranberry (*Vaccinium vitis-idaea,* FAC), Labrador tea (*Ledum groenlandicum,* FACW), and cottongrass tussocks (*Eriophorum vaginatum,* OBL). Small bogs and fens were observed within these shrub communities, dominated by sedges (*Carex spp.* FACU-OBL*)*, marsh five-finger (*Potentilla palustris,* OBL), and sphagnum mosses.

Table 4.3. Definitions for Cowardin wetland types present in the Healy exploration license area.

System	P	Palustrine
Class	SS	Scrub-Shrub
	EM	Emergent
Subclass	1	Broad-leaved Deciduous– dominated by woody angiosperms with relatively wide, flat leaves that are shed during the cold or dry season (*e.g. Salix spp, Betula spp, Vaccinium uliginosum*)
	2	Needle-leaved Deciduous – woody gymnosperms with green, needle-shaped or scale-like leaves that are shed during the cold or dry season (*e.g. Larix larcina*)
	4	Needle-leaved Evergreen – woody gymnosperms with green, needle-shaped, or scale-like leaves that are retained throughout the year (*e.g. Picea marianna, Empetrum nigrum*)
Hydrology modifier	B	Substrate is saturated
	E	Substrate is seasonally flooded saturated

Source: Cowardin et al. 1979.

3. Freshwater Habitats

The streams, rivers, and lakes of the Healy Basin provide a wide variety of freshwater habitats for fish and wildlife of the area. They serve as migratory corridors, provide habitat for spawning, rearing and overwintering, vegetative cover, are a significant source of detritus, and are frequently migrations corridors for wildlife (ADF&G 2006). Freshwater habitats range from small, intermittent streams to large rivers, and from ponds to large lakes. Water sources for these habitats include

glacial melt, snowmelt, precipitation, and groundwater such as springs and upwelling areas. Lake and pond habitats are influenced by substrate, bathymetry, and shoreline contour (ADF&G 2006).

The Nenana River flows through the central portion of the Healy Basin. Although the main channel of the Nenana River is glacially turbid during most of the ice-free period, it has numerous clear side channels and tributaries. The type of habitat provided by streams and rivers is defined by the substrate, which includes large boulders, cobble, gravel, glacial silt, clay, and mud. Stream and river morphology also contributes to defining the habitat, including such characteristics as straight, meandering, or braided; and morphologic complexity is an important contributor to habitat quantity and quality (ADF&G 2006). Large woody debris in rivers and streams is important for stabilizing banks and substrates, provides cover, creates pool habitats, and increases stream productivity (ADF&G 2006).

The area is crossed by rivers and streams that provide habitat for anadromous and resident fish species. Many of the freshwaters of the Healy Basin provide important spawning, rearing, or migration habitats for anadromous fishes such as salmon, trout, and char. Waters that have been identified as important for anadromous species (Table 4.4) receive special protection under AS 16.05.871. The Catalog of Waters Important for the Spawning, Rearing, or Migration of Anadromous Fishes, the official listing of these waters, is updated annually (Johnson and Daigneault 2008). The Nenana River, Lignite Springs, Unnamed Creek, K-Dog Creek, Panguingue Creek, Little Panguingue Creek, June Creek, and Bear Creek are designated as waters important for the spawning, rearing, or migration of anadromous fishes per AS 16.05.871 (Johnson and Daigneault 2008).

Tarbox et al. (1979) evaluated aquatic habitat in the Nenana River and several of its tributaries in the Healy area. Fish abundance was observed to be relatively low in the Nenana River. Lignite Creek was determined to have marginal aquatic habitat, while Panguingue Creek, Little Panguingue Creek, and Lignite Springs provided excellent habitat for coho salmon, round whitefish, Dolly Varden, and Arctic grayling. June Creek, Bear Creek, and K-Dog Creek were not included in the study.

As shown on Map 4.2, portions of these waters provide migratory, spawning, and summer and winter rearing habitat for coho salmon, Chinook salmon, and chum salmon. Resident fish species use streams and lakes within the area for migration, spawning, and overwintering, varying with species and location. Waters that provide anadromous fish habitat also provide resident fish habitat, and several areas within the area provide high quality habitat for resident fish only.

In addition, the license area provides suitable habitat within the known range of dabbling or diving ducks (ADF&G 1986b), such as the Nenana River, which is a migration corridor for ducks and geese (ADF&G 1986b). The license area also includes migration routes for both trumpeter and tundra swans (McIntyre 2004; Day et al. 2000).

B. Fish and Wildlife Populations

The Healy Basin area is home to a wide diversity of fish and wildlife species representing a broad spectrum of life histories and habitat requirements.

1. Fish

Abundance of various fish populations depends on many factors, including ecological parameters such as food and predator abundance, reproductive success and survival, and habitat availability, as well as on human factors such as harvest rates. Resident fish species are often used by humans, but are most valuable as forage species for piscivorous species of fish (*e.g.* sculpin and suckers), birds, and mammals. Table 4.5 lists anadromous and resident fish in the license area.

Stocks of Arctic grayling *(Thymallus arcticus)* and round whitefish spawn and rear in this area, and burbot are seasonally present.

Table 4.4. Catalogued anadromous fish streams within the Healy exploration license area.

Catalog No.	Stream Name	Fish Species[a]
334-40-11000-2490-3200	Nenana River	CHp, COp, Kp
334-40-11000-2490-3200-4086	Lignite Springs	COs
334-40-11000-2490-3200-4086-5010	K-Dog Creek	COs
334-40-11000-2490-3200-4079	Unnamed Creek	COrs
334-40-11000-2490-3200-4075	Panguingue Creek	AG, WF, COrs
334-40-11000-2490-3200-4071	Little Panguingue Creek	AG, COs
334-40-11000-2490-3200-4220	June Creek	COs, CHs
334-40-11000-2490-3200-4220-5016	Bear Creek	COs, CHs
334-40-1100-2490-3200-4091	Healy Creek	CHp
334-40-1100-2490-3200-4091-5102	Moody Creek	CHs

[a] K=chinook salmon, CO=coho salmon, S=sockeye salmon, P=pink salmon, CH=chum salmon, AG=Arctic grayling, NP=northern pike, WF=whitefish, SF=sheefish, s=spawning, p=passage and r=rearing.

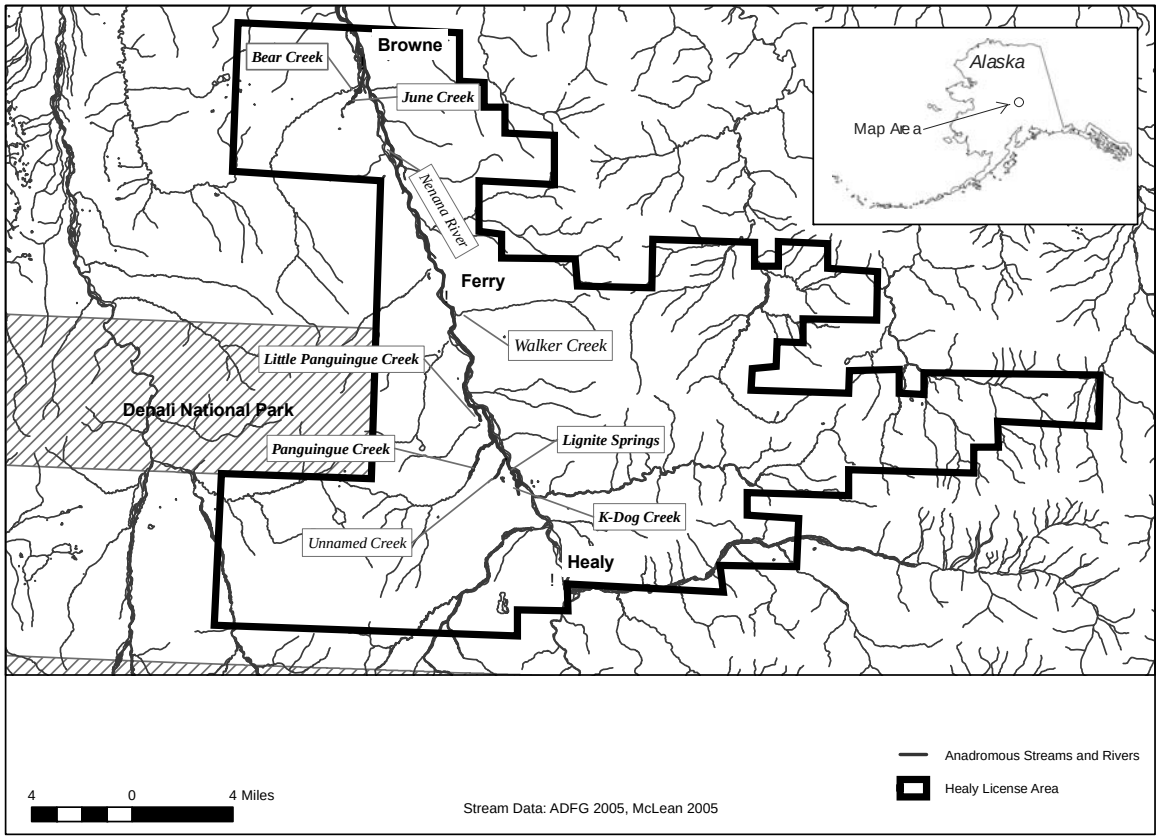
Source: Johnson and Daigneault 2008; McLean 2003.

Dolly Varden (*Salvelinus malma*) are found in many rivers and streams throughout the Healy Basin area. They are closely related to **Arctic char** (*S. alpinus*), and in fact, distinguishing the two species requires counting gill rakers and pyloric caeca (Morrow 1980). Although Dolly Varden generally spawn in the fall, their life history is notoriously variable. For example, Dolly Varden populations can be sea-run (spending time in freshwater and nearshore marine waters) or resident (spending their entire life in freshwater), and within the same population some individuals may be sea-run while others are resident. Among freshwater residents, there are lake, stream, and dwarf forms (ADF&G 1994). All forms of Dolly Varden may spawn more than once, although there is generally a high mortality rate after spawning (ADF&G 1994). Their life span can be up to 18 years, but usually it is less than 10 years (Armstrong 1996). In freshwater, Dolly Varden eat unburied salmon eggs and young, insects and crustaceans (Armstrong 1996).

Burbot (*Lota lota*) are found in deep rivers and lakes throughout the Healy Basin area. They spawn in moderately shallow waters of rivers or lakes under the ice in the winter, February through March (Armstrong 1996). Burbot do not build nests for their eggs, but are broadcast spawners averaging about 1 million eggs per female (Sisinyak 2005; Armstrong 1996). Eggs settle to the bottom and hatch in about 30 days (Morrow 1980). Young burbot feed on invertebrates; as they grow, their diet also includes fish such as slimy sculpin, lampreys, and young salmon; by age 5 their diet is primarily fish (Armstrong 1996). Burbot become sexually mature at about age 6 or 7 (Armstrong 1996), and can spawn multiple times. They grow slowly, but have a long life span, up to 24 years (Armstrong 1996). Burbot have been studied extensively in northern Alaska (Bernard et al. 1993), but studies are unavailable specific to the Healy Basin area.

Arctic grayling (*Thymallus arcticus*), which are generally rare in Alaska considering their high appeal to sport fishermen, are throughout the license area. A close cousin of the trout, grayling can be identified by their dark back, gray sides, and black spots scattered across their body.

Arctic grayling can be highly migratory, sometimes traveling up to a 100 miles and using different streams for spawning, juvenile rearing, summer feedings, and overwintering. During the winter these fish prefer glacial rivers and the deeper pools. Their tolerance for low dissolved oxygen allows them to survive the long winters.



Source: Johnson and Daigneault 2008.

Notes: Otto Lake and Eightmile Lake are also within the exploration license boundaries. Otto Lake is stocked by ADF&G with rainbow trout and Eightmile Lake contains Arctic grayling.

Map 4.2. Anadromous streams in the Healy exploration license area.

Table 4.5. Anadromous and resident fish species found in the Healy exploration license area.

Common Name	Scientific Name
Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Chum salmon	*Oncorhynchus keta*
Dolly Varden	*Salvelinus malma*
Arctic grayling	*Thymallus arcticus*
Burbot	*Lota lota*
Round whitefish	*Prosopium cylindraceum*
Slimy sculpin	*Cottus cognatus*
Longnose sucker	*Catosomus catasomus*

Sources: Johnson and Daigneault 2008, Tarbox 1979.

During spring, Arctic grayling begin migrating upstream to the same spawning and feeding grounds as they were reared on. Typically the average age of a mature adult Arctic grayling at the time of spawning is 4 to 5 years old, and 11 to 12 inches long. After spawning adults migrate to summer feeding grounds. Fry will hatch about three weeks after spawning and tend to stay in the quieter waters of their spawning habitat before migrating downstream in the fall to overwintering areas.

The Arctic grayling's primary diet consists of aquatic insects, salmon eggs, and the occasional vole or shrew. Because of their generalist food habits and their tendency to eat almost anything, the Arctic grayling is a popular species among anglers (ADF&G 1994).

2. Birds

Ongoing surveys of avian populations in and around the Healy Basin have been conducted by several programs: the North American Breeding Bird Survey, a cooperative effort between the USGS Patuxent Wildlife Research Center and the Canadian Wildlife Service's National Wildlife Research Center; various National Park Service programs carried out in Denali National Park; and surveys conducted by private firms related to potential development.

Table 4.6 presents a list of birds known to occur within the Healy Basin, as well as an indication of breeding status and seasonal presence in the area.

Ducks found within the Healy Basin include such types as common diving ducks, scoters (*Melanita spp.*), greater and lesser scaup (*Aythya marila* and *A. affinis*), and Barrow's goldeneyes (*Bucephala islandica*). Often observed dabbling ducks include northern pintails (*Anas acuta*), nothern shoveler (*A. clypeata*), green-winged teal (*A. crecca*), American widgeon (A. *Americana)*, and mallards (*A. platyrhynchos*).

Two species of **geese** occur in the Healy Basin: white-fronted geese (*Anser albifrons*) and Canada geese (*Branta canadensis*). White-fronted geese are among the first species of waterfowl to arrive in the spring. The population of white-fronted geese that utilize the Healy area is part of the mid-continent population. This population breeds throughout the western and central Canadian arctic. These birds nest near water in a variety of habitats and remain in Alaska through early fall (ADF&G 1994).

Of the six subspecies of Canada geese found in Alaska, only lesser Canada geese (*B.c. parvipes)* occur in the Healy Basin. Lesser Canada geese nest in Cook Inlet and throughout river drainages between western and interior Alaska, including the license area, and the Yukon Territory, wintering in Washington and Oregon (ADF&G 1994).

There are two species of **swans** in Alaska, trumpeter swans (*Cygnus buccinator*), and tundra swans (*C. columbianus*). Trumpeter swans nest throughout interior and western Alaska, while tundra swans nest primarily in coastal areas from Kotzebue Sound to Bristol Bay. Both of these species winter in coastal areas from Cordova south to central California. Swans begin nesting soon after spring thaw in marsh areas adjacent to lakes. They migrate to their southern range in late September or October. Day et al. (2000) examined avian populations from Healy to Fairbanks, and observed that most swans migrated through the area between October 6 and 12.

Cranes are also found in the license area. The distribution of the mid-continent population of sandhill cranes (*Grus canadensis*) includes the license area. Sandhill cranes summer throughout most of interior and western Alaska, migrating to their nesting habitat in tundra, marshes and muskegs in early to mid May. Cranes return south to their winter ranges in eastern New Mexico, western Texas, and adjacent northern Mexico in mid-September (Kessel 1984; ADF&G 1994). Day et al. (2000) examined avian populations from Healy to Fairbanks, and observed that most sandhill cranes migrated through the area by September 24 for the 1999 season. Observed migration routes were

between Walker and Rex domes via Chicken Creek in the northern portion of the license area if the wind was light or northerly, and north of the foothills if the wind was strong or southerly.

Shorebird species that are found within the Healy Basin include the semipalmated plover (*Charadrius semipalmatus)*, killdeer (*Charadrius vociferous*), lesser yellowlegs (*Tringia flavipes*), solitary sandpiper (*Tringa solitaria)*, spotted sandpiper (*Actitis macularia)*, common snipe (G*allinago gallinago)*, red-necked phalarope (*Phalaropus lobatus)*, wandering tattler (*Heteroscelus icanus*), and upland sandpiper (*Bartramia longicauda).*

Shorebirds occupy a variety of habitats over the course of a year, with the commonality of spending at least part of their time near water. Nesting habitat can range from the low-lying, moist to wet tundra preferred by species such as red-necked phalaropes to the taiga regions within or near muskeg wetlands preferred by the yellowlegs and the solitary sandpiper. Food sources are as varied as habitats, ranging from small fish to invertebrates (Warnock and Wamock 2001; Peterson 2001).

Several species of **raptors** inhabit the license area. The Tanana Basin Area Plan (ADNR 1991) identifies the Nenana River corridor, the Parks Highway corridor, and high-mountain areas of the Healy Basin as capable of supporting maximum densities of various species on a long term basis. Such prime habitat areas are necessary for perpetuation of populations.

A raptor survey in the Healy area documented several species of raptors (Roseneau and Springer 1991), including sharp-shinned hawks (*Accipter striatus*), northern goshawks (*A. gentilus)*, northern harriers (*Circus cyaneus*), red-tailed hawks (*Buteo jamaicensis)*, golden eagles (*Aquila chrysaetos)*, American kestrels (F*alco sparverius)*, merlins (*F. columbarius)*, and a buteo (*Buteo spp.)*. Also documented were eleven golden eagle nesting territories, with six successful pairs, and one red-tailed hawk nesting territory, with one successful pair.

An additional raptor study was conducted for the Usibelli Poker Flat Solid Landfill Permit, issued in 2000 and renewed in 2005. Data provided by McIntyre (2004) lists the following raptors as inhabiting the Healy Basin: osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipiter striatus*), northern goshawk (*Accipter gentilis*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), golden eagle (*Aquila chrysaetos*), American kestrel (*Falco sparverius*), merlin (*Falco columbarius*), peregrine falcon (*Falco peregrinus*), gyrfalcon (*Falco rusticolus*), great-horned owl (*Bubo virginianus*), snowy owl (*Nyctea scandiaca*), northern hawk owl (*Surnia ulula*), great gray owl (*Strix nebulosa*), short-eared owl (*Asio flammeus*), and boreal owl (*Aegolius funereus*).

Bald eagles are protected under the Eagle Protection Act (16 USC §§ 668), which restricts activities such as clearing within 330 feet of eagle nests. Bald eagles usually return to the same nests each year, and interior populations prefer old trees along rivers. Eagles mostly prey on salmon, but may also eat waterfowl and small mammals. Eagles start nest-building in April and may stay in the area after the young leave the nest in August if food sources are available. Most eagles winter in southern Alaska (ADF&G 1994).

Osprey also select nesting habitat near rivers, as fish are their primary food source; they return to the same nests every year in late April. Young osprey hatch in late June and remain in the nest until mid-August. In the fall, osprey migrate south for the winter and most have left Alaska by October (ADF&G 1994).

Great gray owls utilize old hawk nest sites from March to June. Great gray owls do not migrate, but may cover long distances in search of food sources. Owls hunt small rodents by perching on the edges of marshes, sloughs or other open areas (ADF&G 1994). **Northern hawk owls** do not build nests, but lay their eggs in the cavities of broken tops of dead trees, or in large holes in trees. The majority of their diet consists of voles and mice, with occasional insects, mammals as large as hares, and birds as large as grouse (ADF&G 1994).

Table 4.6. Birds found in the Healy exploration license area.

Common Name	Status	Seasonal Occurrence			
		Winter	Spring	Summer	Autumn
Red-throated Loon	migrant		X		X
Pacific Loon	migrant		X		X
Common Loon	migrant		X		X
Horned Grebe	breeder		X	X	X
Red-necked Grebe	breeder		X	X	X
Greater White-fronted Goose	migrant		X		X
Canada Goose	migrant		X		X
Trumpeter Swan	migrant		X		X
Tundra Swan	migrant		X		X
Gadwall	migrant		X		X
American Wigeon	breeder		X	X	X
Mallard	breeder		X	X	X
Northern Shoveler	breeder		X	X	X
Northern Pintail	breeder		X	X	X
Green-winged Teal	breeder		X	X	X
Canvasback	migrant		X		X
Redhead	migrant		X		X
Ring-necked Duck	migrant		X		X
Greater Scaup	potential breeder		X	X	X
Lesser Scaup	breeder		X	X	X
Harlequin Duck	potential breeder		X	X	X
Surf Scoter	migrant		X		X
White-winged Scoter	migrant		X		X
Black Scoter	migrant		X		X
Long-tailed Duck	potential breeder		X	X	X
Bufflehead	potential breeder		X	X	X
Common Goldeneye	migrant		X		X
Barrow's Goldeneye	potential breeder		X	X	X
Red-breasted Merganser	potential breeder		X	X	X
Common Merganser	migrant		X		X
Osprey	migrant		X	X	X
Bald Eagle[a]	breeder		X	X	X
Northern Harrier	breeder		X	X	X
Sharp-shinned Hawk	breeder		X	X	X
Northern Goshawk	breeder	X	X	X	X
Red-tailed Hawk	breeder		X	X	X

-continued-

Table 4.6. Page 2 of 4.

Common Name	Status	Seasonal Occurrence			
		Winter	Spring	Summer	Autumn
Rough-legged Hawk	migrant		X		X
Golden Eagle[a]	breeder		X	X	X
American Kestrel	breeder		X	X	X
Merlin	breeder		X	X	X
Peregrine Falcon	potential breeder		X	X	X
Gyrfalcon	breeder	X	X	X	X
Ruffed Grouse	breeder	X	X	X	X
Spruce Grouse	breeder	X	X	X	X
Willow Ptarmigan	breeder	X	X	X	X
Rock Ptarmigan	breeder	X	X	X	X
White-tailed Ptarmigan	breeder	X	X	X	X
Sandhill Crane	migrant		X		X
Black-bellied Plover	migrant		X		X
American Golden-Plover	breeder		X	X	X
Semipalmated Plover	breeder		X	X	X
Lesser Yellowlegs	breeder		X	X	X
Solitary Sandpiper	breeder		X	X	X
Wandering Tattler	breeder		X	X	X
Spotted Sandpiper	breeder		X	X	X
Upland Sandpiper	breeder		X	X	X
Whimbrel	breeder		X	X	X
Surfbird	potential breeder		X	X	X
Sanderling	migrant		X		X
Semipalmated Sandpiper	migrant		X		X
Western Sandpiper	migrant		X		X
Least Sandpiper	migrant		X		X
Baird's Sandpiper	potential breeder		X	X	X
Pectoral Sandpiper	migrant		X		X
Wilson's Snipe	breeder		X	X	X
Red-necked Phalarope	potential breeder		X	X	X
Long-tailed Jaeger	breeder		X	X	X
Bonaparte's Gull	breeder		X	X	X
Mew Gull	breeder		X	X	X
Herring Gull	potential breeder		X	X	X
Glaucous-winged Gull	migrant/vagrant		X		X
Arctic Tern	breeder		X	X	X

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Table 4.6. Page 3 of 4.

Common Name	Status	Seasonal Occurrence			
		Winter	Spring	Summer	Autumn
Great-horned Owl	breeder	X	X	X	X
Snowy Owl	vagrant	X	X		X
Northern Hawk Owl	breeder	X	X	X	X
Great Gray Owl	potential breeder	X	X	X	X
Short-eared Owl	breeder		X	X	X
Boreal Owl	breeder	X	X	X	X
Belted Kingfisher	breeder		X	X	X
Downy Woodpecker	potential breeder	X	X	X	X
Hairy Woodpecker	breeder	X	X	X	X
Three-toed Woodpecker	breeder	X	X	X	X
Black-backed Woodpecker	potential breeder	X	X	X	X
Northern Flicker	breeder		X	X	X
Olive-sided Flycatcher	breeder		X	X	X
Yellow-bellied Flycatcher	potential breeder		X	X	X
Western Wood-Pewee	breeder		X	X	X
Alder Flycatcher	breeder		X	X	X
Hammond's Flycatcher	breeder		X	X	X
Say's Phoebe	potential breeder		X	X	X
Northern Shrike[a]	breeder	X	X	X	X
Gray Jay	breeder	X	X	X	X
Black-billed Magpie	breeder	X	X	X	X
Common Raven	breeder	X	X	X	X
Horned Lark	breeder		X	X	X
Tree Swallow	breeder		X	X	X
Violet-green Swallow	breeder		X	X	X
Bank Swallow	potential breeder		X	X	X
Cliff Swallow	potential breeder		X	X	X
Black-capped Chickadee	breeder	X	X	X	X
Boreal Chickadee	breeder	X	X	X	X
Red-breasted Nuthatch	potential breeder	X	X	X	X
Brown Creeper	potential breeder	X	X	X	X
American Dipper	potential breeder	X	X	X	X
Ruby-crowned Kinglet	breeder		X	X	X
Arctic Warbler	breeder		X	X	X
Northern Wheatear	potential breeder		X	X	X
Townsend's Solitaire	breeder		X	X	X

-continued-

Table 4.6. Page 4 of 4.

Common Name	Status	Seasonal Occurrence			
		Winter	Spring	Summer	Autumn
Gray-cheeked Thrush	breeder		X	X	X
Swainson's Thrush	breeder		X	X	X
Hermit Thrush	breeder		X	X	X
American Robin	breeder		X	X	X
Varied Thrush	breeder		X	X	X
American Pipit	breeder		X	X	X
Bohemian Waxwing	potential breeder		X	X	X
Orange-crowned Warbler	breeder		X	X	X
Yellow Warbler	breeder		X	X	X
Yellow-rumped Warbler	breeder		X	X	X
Townsend's Warbler	potential breeder		X	X	X
Blackpoll Warbler	breeder		X	X	X
Northern Waterthrush	potential breeder		X	X	X
Wilson's Warbler	breeder		X	X	X
American Tree Sparrow	breeder		X	X	X
Savannah Sparrow	breeder		X	X	X
Fox Sparrow	breeder		X	X	X
Lincoln's Sparrow	breeder		X	X	X
White-crowned Sparrow	breeder		X	X	X
Golden-crowned Sparrow	breeder		X	X	X
Dark-eyed Junco	breeder		X	X	X
Lapland Longspur	breeder		X	X	X
Smith's Longspur	potential breeder		X	X	X
Snow Bunting	migrant		X	X	X
Rusty Blackbird	potential breeder		X	X	X
Gray-crowned Rosy Finch	potential breeder		X	X	X
Pine Grosbeak	potential breeder	X	X	X	X
White-winged Crossbill	breeder	X	X	X	X
Common Redpoll	breeder	X	X	X	X
Hoary Redpoll	potential breeder	X	X	X	X
Pine Siskin	potential breeder		X	X	X

[a] Overwinters occasionally.

Key to status:
Migrant: Occurs in area during spring and autumn migration.
Breeder: Regularly nests in the area.
Potential breeder: most likely nests in area, but breeding not confirmed by field observations.
Vagrant: Occurs occasionally.

Source: McIntyre 2004.

3. Terrestrial Mammals

Numerous species of terrestrial mammals inhabit the Healy Basin, including caribou, moose, black bear, and brown bear. Other terrestrial mammals include furbearers and small game. The Healy Basin is designated as a wildlife management area (ADNR 1991), and includes ADF&G Game Management Units (GMU) 20A and 20C.

Two herds of **caribou** (*Rangifer tarandus*), the Denali Caribou Herd and Delta Caribou Herd, are present in the Healy Basin on a seasonal basis. Caribou habitat is shown on Map 4.3.

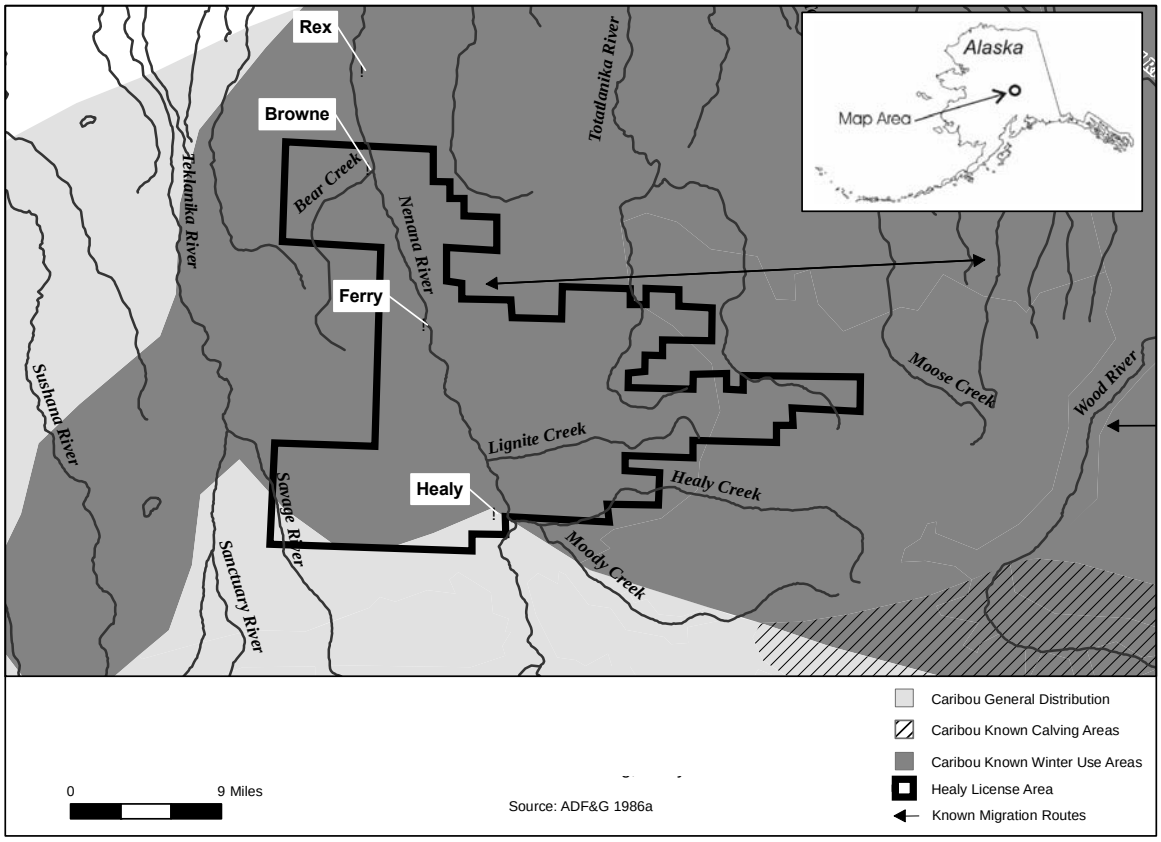
The Delta Caribou Herd range encompasses the Healy Basin, and a known migration pattern runs east-west just north of Ferry (ADF&G 1986a; Table 4.7). No known calving areas for the herd are located within the Healy Basin. ADF&G has monitored the population size of the Delta Caribou Herd since the 1960s. The herd has fluctuated between 2,500 and 10,700 caribou, with several distinct growth phases. In 2004, the herd was estimated at 2,211 animals (Young 2007; Table 4.7).

The range of the Denali Caribou Herd is almost exclusively within the boundaries of Denali National Park and Preserve. The Denali Caribou Herd inhabits most of the park east of Foraker River and north of the Alaska Range throughout most of the year. Some animals of the Denali Caribou Herd occasionally travel south of the Alaska Range toward the vicinity of Cantwell during the calving season. A small portion of the wintering range of the Denali Caribou Herd outside Denali National Park and Preserve (Tanana Basin Area Plan Subunit 4E1) is in or adjoins the license area, in what are called the Wolf Townships. A Denali National Park and Preserve map of observed locations for the Denali Caribou Herd shows much higher densities outside the license area, to the west on state land and further west into the park, as well as north and south into DNPP (Anderson 2005). UCM intentionally restricted the boundary of the license area in these townships to avoid important habitat, and most of the Wolf Townships' critical caribou habitat are excluded.

Research conducted on the Denali Caribou Herd is important because it is the only barren-ground caribou herd in North America of such a large population that is currently not hunted. Currently, there are approximately 2,080 caribou in Denali National Park and Preserve (NPS 2008).

The entire exploration license area is a known **moose** (*Alces alces gigas*) winter concentration area. Known moose calving and rutting concentration areas exist east of the Nenana River (ADF&G 1986a; Map 4.4). Moose populations in GMU 20A, of which the Healy Basin is in the far western portion, were estimated in 2005 at 16,018 animals (Young 2006a). GMU 20C, which includes drainages into the west bank of the Nenana River, has had low moose densities for many years, presumably due to predation. An estimated 3,500-4,500 moose inhabited GMU 20C during survey years 2003 to 2005, with 1,500-2,000 of these animals outside Denali National Park and the remainder inside the park (Seaton 2006).

Moose calving occurs from mid-May to early June and rutting occurs in late September to early October. Moose may migrate between calving, rutting and winter habitats from distances of only a few miles to over 60 miles (ADF&G 1994). In the spring and summer, moose feed in open areas including aquatic environments, on food sources such as sedges (*Carex* spp.), horsetails (*Equisetum* spp.), pond weeds (*Potamogeton* spp.), grasses and the leaves and succulent leaders of birch (*Betula* spp.), apsen (*Populus tremuloides*) and willows (*Salix* spp.). Shrubs and trees provide important habitat in the spring and summer for calving, predator protection and bedding. The preferred winter forage for moose are willows; in Interior Alaska feltleaf (*Salix alaxensis*) and diamondleaf (*S. pulchra*) willows are most preferred followed by scouler (*S. scouleriana*) and halbred (*S. hastata*) willows. Paper birch (*Betula papyrifera*) and quaking aspen (*Populus tremuloides*) are also used as winter forage species second to willows. Open shrub and emergent communities are the most important winter habitat for moose; as snow depth increases, they move to closed canopy forests with available understory vegetation (ADF&G 1994).



Map 4.3. Caribou habitat in the exploration license area.

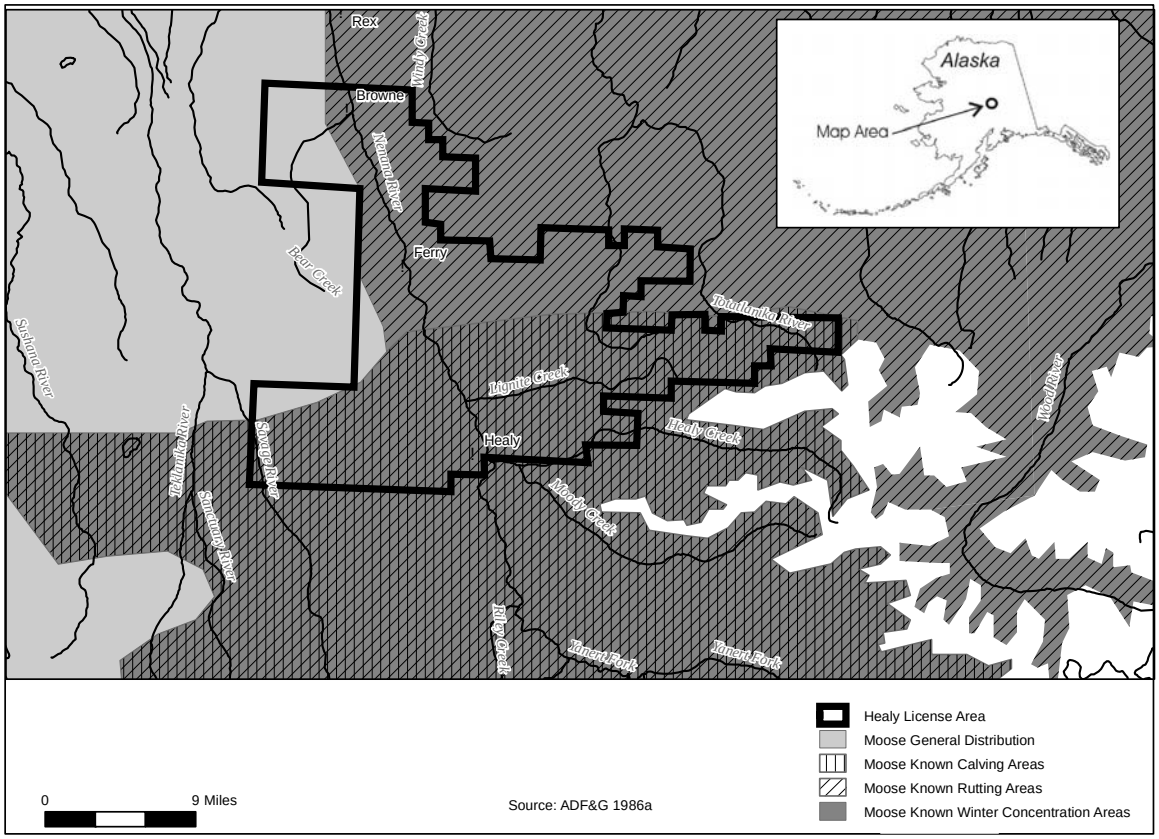
Source: ADF&G 1986b.

Table 4.7. Estimated population of the Delta Caribou Herd, 1991-2006.

Year	Minimum Herd Size	Year	Minimum Herd Size
1991	5,755	1999	3,227
1992	5,877	2000	3,227
1993	3,661	2001	2,950
1994	4,341	2002	2,803
1995	4,646	2003	2,581
1996	4,019	2004	2,211
1997	3,699	2005	[a]
1998	3,829	2006	[a]

[a] Census was not conducted.

Source: Young 2007.



Source: ADF&G 1986b.

Map 4.4. Moose habitat in the exploration license area.

The general distribution of **brown bears** (*Ursus arctos*) encompasses the Healy Basin (ADF&G 1986b). Brown bear densities are seasonally variable dependent upon available food sources. The highest densities of brown bear are found in the mountains, foothills, and mountain valleys, and the lowest densities are found in the forested lowlands.

Brown bears are opportunistic omnivores, heavily dependent upon plants. Spring food sources include plant species such as cow parsnip (*Heracleum lanatum*), sedges (*Carex spp.*), horsetails (*Equisetum spp.*), lupine (*Lupinus spp.*) and grasses. The berries of salmonberry (*Rubus spectabilis*), devil's club (*Opplopanax horridus*), crowberries (*Empetrum nigrum*), blueberries (*Vaccinium uliginosum*), soapberries (*Shepherdia canadensis*), and lowbush cranberries (*Vaccinium vitis-idaea*) are readily eaten when available (ADF&G 1986b). During the summer to fall, salmon are used extensively as a food source when and where available, as well as carrion from winter kills and moose and caribou calves.

Black bears (*Ursus americanus*) are present throughout the Healy Basin, however, densities of black bears are relatively low compared to other areas (Seaton 2005). Estimates for black bear populations in 1995 included 500-700 bears in GMU 20A and 700-1,000 bears in GMU 20C, excluding Denali National Park (Seaton 2005). Black bear distribution is variable and shifts seasonally. After emerging from dens in the spring, black bears tend to use birch-aspen habitats and feed on forbs and

grasses. During the fall, they shift to black spruce-tamarack habitats and feed primarily on blueberries (Smith et al. 1994).

Wolves (*Canis lupus*) are found in the exploration license area. The estimated abundance of wolf populations for 2004 in GMU 20A was 200-250 animals separated into 20-25 packs, and for GMU 20C, the estimated population was 150-200 animals separated into 25-35 packs (Young 2006b). ADF&G conducted wolf predation control programs in GMU 20A from autumn 1975 to spring 1982, and from October 1993 to November 1994. The wolf predation control program in 1993-1994 was instituted to reverse a caribou population decline associated with a density dependent response to unfavorable weather (Young 2006b). In October 2002, the Alaska Board of Game established the Nenana Canyon Closed Area, consisting of portions of Units 20A and 20C, as closed to the taking of wolves. The extent of the closed area was modified in March 2004 and the hunting season was extended in March 2006. In April 2008, there were approximately 18 packs of wolves in the Denali National Park and Preserve with approximately 97 animals (NPS 2008).

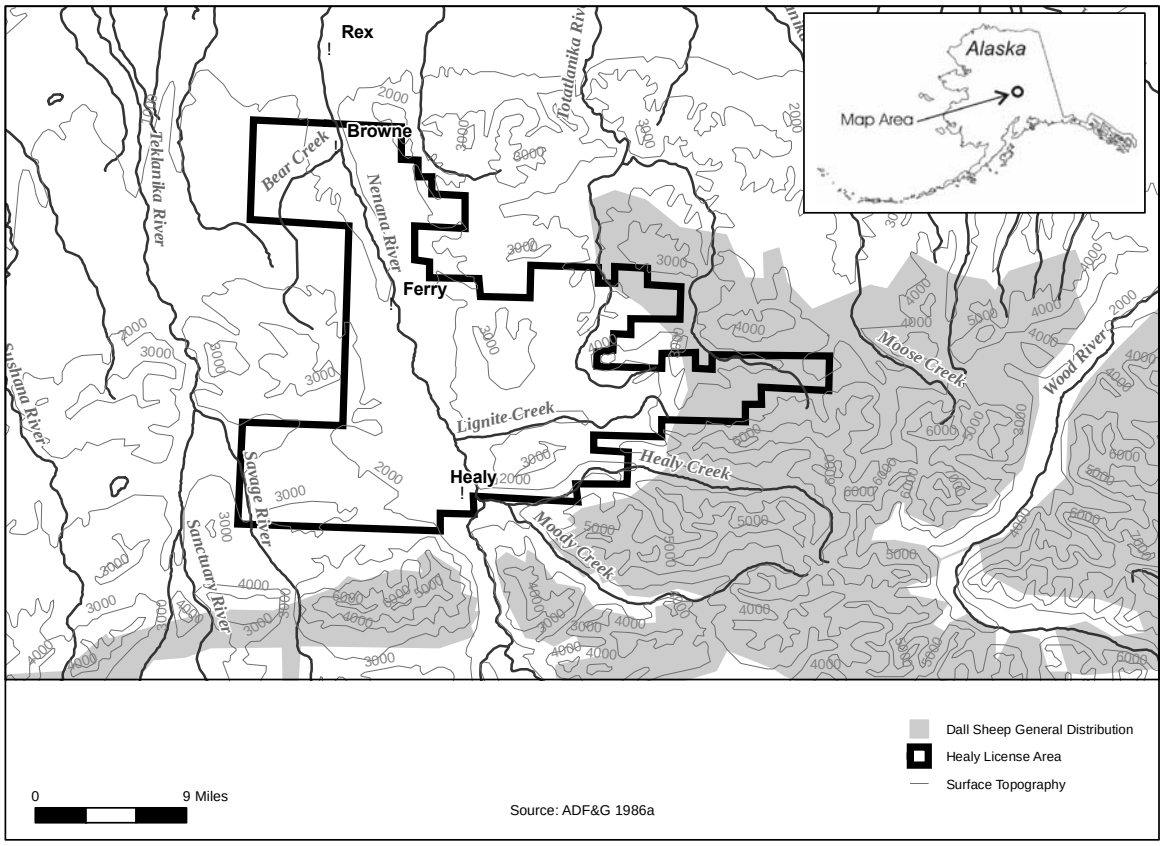
Packs usually stay within a range of about 600 square miles but may move outside their territory if they depend on migratory caribou for a food source. Moose and caribou are the primary food sources for wolves in Interior Alaska although Dall sheep may also be taken where available. Supplemental food sources in the summer include small mammals, birds, and fish (ADF&G 1994). The abundance of wolves and other predators in the area is ultimately determined by the availability of prey and game management efforts. The ability of adults to provide food is the key determinant in survival of the young; a reduction in prey species would reduce predator populations (USFWS 1987).

Dall sheep (*Ovis dalli dalli*) occur within the Healy Basin (Map 4.5). Dall sheep populations in GMU 20A were stable between 1998 and 2001. Dall sheep are typically found above 2,500 feet in suitable alpine habitat. Seasonal range use varies by populations. Some populations are rather sedentary, with summer ranges merely an extension of winter ranges (Geist 1971). Other populations, however, migrate to distinct seasonal ranges. These migration routes may be lost if older animals who lead the migrations are eliminated from the population, which would explain why apparently suitable habitat is unoccupied by Dall sheep (Geist 1971; Beckstead 2004). The precipitous, rocky terrain preferred by Dall sheep does not vary much on a seasonal basis, though sheep do move to lower elevations in the spring for lambing. During the winter, Dall sheep in the Alaska Range feed on the exposed leaves and seed heads of sedges (*Carex spp.*) and grasses (*Calamagrostis spp., Festuca spp., Agropyron spp.*) and the stems of lowbush cranberry (*Vaccinium vitis-idaea)*. When moving to lower elevations for lambing, additional species are added to the diet as soon as they leaf out. Species included in the summer diet are *Dryas octopetala,* sedges (*Carex spp.*), willows (*Salis polaris speudopolaris* and *S. reticculata*), and forbs such as *Epilobium latifolium, Oxyria digyna,* and *Geum rossi* (ADF&G 1986b).

Beavers (*Castor canadensis*) require water levels of two to three feet year round for protection from predators. They may construct bank dens on streams or river banks or lodges in more slow moving waters such as ponds or lakes. Beavers rely on bark, aquatic plants, roots, and grasses for food and will move to a new location when food supplies have been exhausted (ADF&G 1994).

River otters (*Lutra canadensis*) den in subterranean burrows and hunt both on land and in water. Food sources include frogs, fish, and occasionally birds, mammals and plants (ADF&G 1994).

Marten (*Martes americana*) occupy ranges from one to fifteen square miles depending on food availability. Their primary food sources are meadow voles, red-backed voles, mice, berries, small birds, eggs and plants. Hunting habitats include the edges of spruce forests along streams and bog meadows (ADF&G 1994).



Source: ADF&G 1986a.

Map 4.5. Distribution of Dall sheep in the Healy exploration license area.

Red foxes (*Vulpes vulpes*) prefer lowland marshes and hills and gullies. Foxes live in underground dens which are 15 to 20 feet-in length, often having several entrances. Foxes are omnivores, relying on a diverse food supply, including muskrats, squirrels, hares, birds, eggs, insects, plants, carrion, and voles (ADF&G 1994).

Lynx (*Lynx canadensis*) inhabit a variety of habitats, though the preferred habitat is a mixture of vegetation types and early successional status. This is also excellent habitat for snowshoe hares, a key prey species for lynx. Lynx populations fluctuate with hare populations, which typically undergo an eight to eleven year cycle of abundance (ADF&G 1994). Populations are expected to increase as hare populations, a primary food source for lynx, also increase (Seaton 2007).

Wolverines (*Gulo gulo*) are solitary animals found throughout remote arctic and subarctic Alaska. Opportunistic feeders, wolverines are well adapted for scavenging. Primary food sources include the remains of moose and caribou kills, as well as small and medium sized animals such as voles, snowshoe hares, squirrels, and birds (ADF&G 1994).

C. References

ADF&G (Alaska Department of Fish and Game)

1986a Alaska habitat management guide, interior and western regions. Map atlas. Alaska Department of Fish and Game.

ADF&G (Alaska Department of Fish and Game)
1986b Alaska habitat management guide: life histories and habitat requirements of fish and wildlife. Alaska Department of Fish and Game.

ADF&G (Alaska Department of Fish and Game)
1994 ADF&G wildlife notebook series (with 1999 and 2003 updates for some species). http://www.adfg.state.ak.us/pubs/notebook/notehome.php

ADF&G (Alaska Department of Fish and Game)
2006 Our wealth maintained: A strategy for conserving Alaska's diverse wildlife and fish resources. Alaska Department of Fish and Game, Juneau. http://www.sf.adfg.state.ak.us/statewide/ngplan/NG_outline.cfm

ADNR (Alaska Department of Natural Resources)
1991 Tanana Basin Area Plan for State Lands. ADNR, Fairbanks, AK.

Anderson, P.
2005 Personal communication from superintendent, Denali National Park and Preserve to Jonne Slemons. October 31.

Armstrong, R. H.
1996 Alaska's fish: A guide to selected species. Alaska Northwest Books, Seattle, WA.

Beckstead, D.
2004 The effects of military jet overflights on Dall's sheep in Interior Alaska. http://www.arlis.org/docs/vol1/58732389/index.html

Bernard, D. R., J. F. Parker and R. Lafferty
1993 Stock assessment of burbot populations in small and moderate-size lakes. North American Journal of Fisheries Management 13:657-675.

BLM
1998 Northern Intertie Project: Final EIS. Bureau of Land Management U.S. Department of the Interior, Alaska State Office.

Cowardin, L. M., V. Carter, F. C. Golet and E. T. LaRoe
1979 Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior Fish and Wildlife Service. http://www.npwrc.usgs.gov/resource/wetlands/classwet/index.htm

Day, R. H., R. J. Richie and A. M. Wildman
2000 Avian studies along the proposed Northern Intertie powerline project, fall 1999. Unpublished report prepared for Golden Valley Electric Association, Inc ABR, Inc., Fairbanks, AK.

Environmental Laboratory
1987 Corps of Engineers wetlands delineation manual. U.S. Army Engineer Waterways Experiment Station Technical Report Y-87-1 (online edition), Vicksburg, MS. http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf

Geist, V.
1971 Mountain Sheep: A Study in Behavior and Evolution. University of Chicago Press, Chicago, IL.

Helm, D.
1985 Pre-mining vegetation inventory, Poker Flats permit area, Usibelli Coal Mine. Usibelli Coal Mine, Inc., Agriculture and Forestry Experiment Station, UAF, Palmer Research Center.

Johnson, J. and M. Daigneault
2008 Catalog of waters important for spawning, rearing, or migration of anadromous fishes - Southcentral Region, effective June 2, 2008. Alaska Department of Fish and Game, Special Publication No. 08-05, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/sp08-05.pdf

Kessel, B.
1984 Migration of sandhill cranes, *Grus canadensis,* in east-central Alaska, with routes through Alaska and western Canada. Canadian Field-Naturalist 98(3):279-292.

McIntyre, C.
2004 Personal communication from Wildlife Biologist, Denali National Park and Preserve. Personal communication 11/23/2004 to Oasis.

McLean, R. F.
2003 Memorandum on subject applications by Usibelli Coal Mine, Inc. for shallow natural gas leases in the Healy/Usibelli Mine area. Alaska Department of Natural Resources, Office of Habitat Management and Permitting, Fairbanks, Alaska.

Morrow, J. E.
1980 The freshwater fishes of Alaska. Alaska Northwest Publishing Company, Anchorage, AK.

Nowacki, G., P. Spencer, M. Fleming, T. Brock and T. Jorgenson
2001 Ecoregions of Alaska: U.S. Geological Survey Open-File Report 02-297 (map).

NPS (National Park Service)
2008 Large mammals...how many are there? Denali National Park and Preserve. http://www.nps.gov/dena/naturescience/upload/Large-Mammals-how-many-are-there.pdf Accessed April 2009.

Peterson, W. R.
2001 Plovers and lapwings. *In* The Sibley guide to bird life and behavior, C. Elphick, J.B. Dunning, Jr. and D.A. Sibley, eds. Pages 257-264. Alfred A. Knopf, New York.

Roseneau, D. G. and A. Springer
1991 Raptor surveys in the vicinity of the Healy clean coal project near Healy, Alaska, May 30-31 and July 21-22, 1991.

Roth, J. E., J. G. Kidd, M. D. Smith and L. L. Jacobs
1997 Wetland survey for proposed Northern Intertie - Healy to Fairbanks. Golden Valley Electric Association, Inc., Fairbanks, Alaska.

Seaton, C. T.
2005 Units 20A, 20B, 20C, and 20F black bear management report. *In* Black bear management report of survey and inventory activities 1 July-30 June 2004. C. Brown, editor. Pages 223-247. Project 17.0, Alaska Department of Fish and Game. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/05blbweb.pdf

Seaton, C. T.
2006 Units 20C, 20F, and 25C moose management report. *In* Moose management report of survey and inventory activities 1 July 2003 through 20 June 2005. P. Harper, editor. Pages 363-376. Project 1.0, Alaska Department of Fish and Game. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/06_moose.pdf

Seaton, C. T.
2007 Units 20A, 20B, 20C, 20F, and 25C furbearer. *In* Furbearer management report of survey and inventory activities 1 July 2003 - 30 June 2006. P. Harper, ed. Pages 240-257 Alaska Department of Fish and Game. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/07_fur.pdf

Sisinyak, N.
2005 The poor man's lobster of the Tanana Valley burbot. Alaska Fish and Wildlife News. April 2005. http://www.wildlifenews.alaska.gov/index.cfm?adfg=wildlife_news.view_article&articles_id=137&issue_id=25 Accessed February 6, 2008.

Smith, M. E., J. L. Hechtel and E. H. Follman
1994 Black bear denning ecology in Interior Alaska. International conference on bear research and management. 9(11): 513-522.

Tarbox, K. E., M. A. Scott, D. O. McKay and M. R. Joyce
1979 Biological studies of a proposed power plant site near Healy, Alaska, May-October 1978. Prepared by Woodward-Clyde Consultants for Golden Valley Electric Association, Inc., Fairbanks, Alaska.

USDA (U.S. Department of Agriculture)
2009 Plants database, Natural Resources Conservation Service. http://plants.usda.gov/index.html Accessed April 2009.

USDOE (U.S. Department of Energy)
1993 Final environmental impact statement for the proposed Healy clean coal project. Volume I of III, DOE/EIS-0186.

USFWS (U.S. Fish and Wildlife Service)
1987 ANWR, coastal plain resource assessment report and recommendation to the Congress of the United States and final legislative EIS. U.S. Department of the Interior; U.S. Geological Survey; and U.S. Bureau of Land Management. http://library.fws.gov/Pubs7/ANWR_coastal_LEIS.pdf

USFWS (U.S. Fish and Wildlife Service)
1988 National list of vascular plant species that occur in wetlands. U.S. Fish and Wildlife Service Biological Report 88 (26.9).

Viereck, L. A., C. T. Dymess, A. R. Batten and K. J. Wenzlick
1992 The Alaska vegetation classification. Forest Service U.S. Department of Agriculture, Pacific Northwest Research Station,Portland, OR. Gen. Tech. Rep. PNW-GTR-286. http://www.fs.fed.us/pnw/publications/pnw_gtr286/

Warnock, N. and S. Wamock
2001 Sandpipers, phalaropes, and allies. *In* The Sibley guide to bird life and behavior. C. Elphick, J.B. Dunning Jr., and D.A. Sibley, eds. Pages 283-287. Alfred A. Knopf, New York.

Winterberger, K. C.
1984 Landsat data and aerial photographs used in a multiphase sample of vegetation and related resources in Interior Alaska. *In* Inventorying forest and other vegetation of the high latitude and high altitude regions. V.J. LaBau and C.J. Kerr, eds. Pages 157-163. Proceedings, Society of American Foresters, Fairbanks, Alaska.

Young, D. D.
2006a Unit 20A moose management report. Pages 322-343 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003-30 June 2005. Alaska Department of Fish and Game, Juneau, Alaska. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/sh05mt.pdf

Young, D. D.
2006b Unit 20A, 20B, 20C, 20F, and 25C wolf management report. *In* . , editor. Pages Pages 154-165 *in* P. Harper, editor. Wolf management report of survey and inventory activities 1 July 2002-30 June 2005. Alaska Department of Fish and Game, Juneau, Alaska. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/06_wolf.pdf

Young, D. D.
2007 Unit 20A caribou. Pages 122-134 *in* P. Harper, editor. Caribou management report of survey and inventory activities 1 July 2004 - 30 June 2006 Project 3.0. Alaska Department of Fish and Game, Juneau, Alaska. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/07_caribou.pdf

Chapter Five: Current and Projected Uses in the License Area

Table of Contents

List of Tables

List of Maps

Chapter Five: Current and Projected Uses in the License Area

AS 38.05.035(g) directs that best interest findings consider and discuss the current and projected uses in the area, including uses and value of fish and wildlife. Commercial guiding, hunting, trapping, recreation, and mining are the major land uses in the area (ADNR 1991). The fish and wildlife of the area provide the resource base for subsistence, sport fishing and hunting, and gathering. The area is extensively used for recreation and tourism, attracting hundreds of thousands of visitors to Denali National Park and Preserve. The primary industrial uses of the area are coal development, followed by mining. The area east of Healy is one of the most active mineral exploration and production areas in the state. The projected uses of the license area are anticipated to remain consistent with current uses.

A. ADNR Area Plan

The Healy Basin exploration license area is within the boundaries of the current Tanana Basin Area Plan (TBAP; Management Unit 4). ADNR is currently revising the plan and has divided the planning area. The western area, which includes the license area, will be considered part of the Yukon-Tanana Area Plan.

TBAP opens all state land in the basin to oil and gas leasing and designates the other uses that will occur on state lands. Because more than one use is allowed on most state lands, the plan establishes guidelines that allow various uses to occur without serious conflicts. One of the goals of the plan is to make metallic and non-metallic minerals, coal, oil and gas, and geothermal resources available to contribute to the energy and mineral supplies and independence of the United States.

B. Congressionally Designated Areas

Mt. McKinley National Park and Preserve is located adjacent to the license area. It was first established by Congress in 1917, as a "game refuge…set apart as a public park for the benefit and enjoyment of the people . . . for recreation purposes by the public and for the preservation of animals, birds, and fish and for the preservation of the natural curiosities and scenic beauties thereof…" (39 Stat. 938).

Separate but adjacent to Mount McKinley National Park, the Denali National Monument was established by Presidential Proclamation on December 1, 1978. This and other Alaska proclamations temporarily preserved areas during the legislative process to pass the Alaska National Interest Lands Conservation Act (ANILCA; 94 Statute 2371). In 1980, Congress passed ANILCA, which combined Mount McKinley National Park and Denali National Monument and renamed them Denali National Park and Preserve.

C. Uses and Value of Fish, Wildlife, and Plants

The fishes, birds, mammals, and plants of the exploration license area are actively used, and viewed, by area residents, tourists, and Alaskans. Management of fish and wildlife in the area can fall under the authority of the state or federal government. Management authorities and types of harvest activities may overlap. Sport and state subsistence hunting and fishing are managed by ADF&G. Subsistence hunting on federal lands, and subsistence fishing on federal waters or waters adjacent to federal lands, are managed by the Federal Subsistence Management Program. Migratory birds are federally managed.

1. Subsistence

Subsistence, in the broad sense, refers to "any harvest or use of fish, wildlife, and wild plants for home use. It also incorporates the noncommercial exchange or sharing of resources…" (Fall et al. 2004).

Under Alaska law, subsistence is defined as "noncommercial, customary and traditional uses" of fish or game resources for a variety of purposes (ADF&G 2005). Only Alaska residents may participate in subsistence fishing and hunting, but local residency is not a criteria for determining eligibility for subsistence. Rather than defining subsistence areas, the Joint Board of Fisheries and Game identify "nonsubsistence areas" based on the economy, culture, and way of life of the area or community. Most of the Healy license area (east of the Parks Highway) is designated as "nonsubsistence". Alaska law (AS 16.05.258) requires that subsistence uses must be consistent with sustained yield.

The Alaska Board of Fisheries and Alaska Board of Game are required to provide subsistence fishing and hunting opportunities when possible, and if harvests must be restricted, subsistence uses must be given priority over other uses. If a fish or game population cannot support harvests for all users, then other consumptive uses must be eliminated first before subsistence uses are limited. If the fish or wildlife population cannot support all subsistence users, then the Boards may distinguish among subsistence users through a system known as "Tier II". In this situation, subsistence users are prioritized based on a point system that takes into account: "1) the customary and direct dependence on the fish stock or game population by the subsistence user for human consumption as a mainstay of livelihood; 2) the proximity of the domicile of the subsistence user to the stock or population; and 3) the ability of the subsistence user to obtain food if subsistence use is restricted or eliminated."

Eligibility for subsistence uses differs between state and federal law. Under current federal law, only qualified rural residents may subsistence hunt or fish under federal subsistence regulations on federal public lands. Some federal public lands remain open to use under state regulation by residents who are not federally qualified subsistence users. The license area encompasses lands where fish and wildlife are managed by the state.

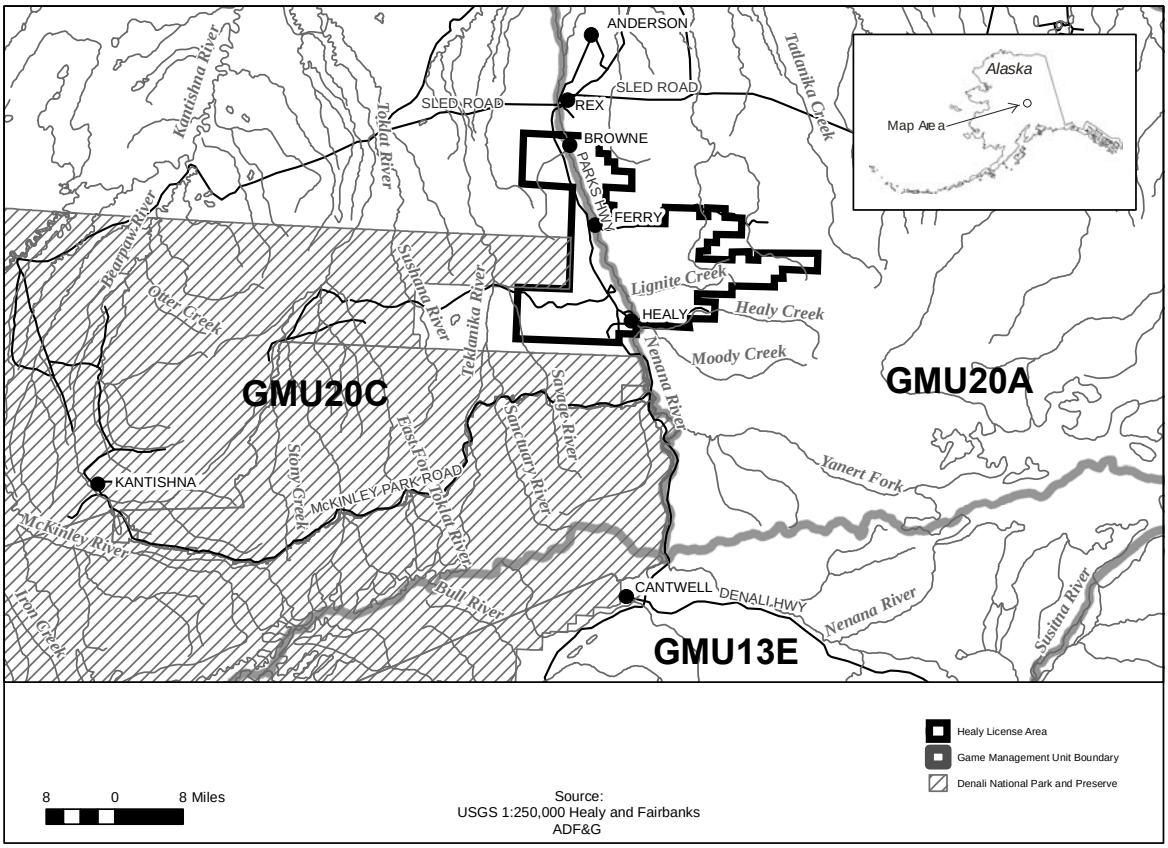
Data on subsistence harvests specific to Healy are lacking, but some information is available for the nearby community of Cantwell. During 1999-2000, residents of Cantwell harvested a total of 27,599 lbs of wild resources, the average household harvest was 293 lbs, and the average harvest per person was 135 lbs (Simeone 2002). Most of the harvest was of land mammals (62%) and fish (25%). Moose, caribou, and sockeye salmon were the most commonly harvested species (Simeone 2002).

2. Sport Hunting and Trapping

The license area is located in GMUs 20A and 20C (Map 5.1). A wide variety of species are taken by local and non-local state residents, as well as individuals from other states and foreign countries. Caribou, moose, and brown bear are the primary big game species harvested in the area. Harvest data for the Delta Caribou Herd in GMU 20A and brown bears and moose in GMUs 20A and 20C are presented in Table 5.1 through Table 5.3.

Harvest for the Delta Caribou Herd averaged 36.2 caribou over a ten year period (Table 5.1). There are no data for caribou representing non-hunting kills. From 1997-2006, harvest of brown bears ranged from 9-18 bears in GMU 20A and 1-10 bears in GMU 20C (Table 5.2). Total harvest of moose by local resident, nonlocal resident, and nonresident hunters ranged from 331-657 moose in GMU 20A and from 9-152 moose in GMU 20C.

In addition to caribou, brown bear, and moose, hunters also harvest black bear, Dall sheep, wolves, and waterfowl. Harvest data for black bears, Dall sheep, and furbearers in GMUs 20A and 20C is presented in Table 5.4 through Table 5.6. The reported lynx harvest in GMUs 20A and 20C increased annually for regulatory years 1995-1996 through 2000-2001, then decreased from 2003-



Map 5.1. ADF&G Game Management Units in the license area.

Table 5.1. Delta Caribou Herd harvest, GMU 20A, 1996-2006.

Year	Harvest
1996-1997	22
1997-1998	44
1998-1999	50
1999-2000	38
2000-2001	24
2001-2002	33
2002-2003	37
2003-2004[a]	33
2004-2005	46
2005-2006	35

[a] Includes 1 bull killed in hunt SC827 (Governor's Permit).

Table 5.2. Brown bear harvest in GMUs 20A and 20C, 1995-2005.

Year	Hunting Kill[a]	Non-Hunting Kill	Total
GMU 20A			
1997-1998	14	3	17
1998-1999	9	0	9
1999-2000	15	3	18
2000-2001	11	0	11
2001-2002	12	2	14
2002-2003	10	0	10
2003-2004	13	0	13
2004-2005	14	0	14
2005-2006	9	1	10
GMU 20C			
1997-1998	5	0	5
1998-1999	3	0	3
1999-2000	6	2	8
2000-2001	8	2	10
2001-2002	7	0	7
2002-2003	6	0	6
2003-2004	2	0	2
2004-2005	8	0	8
2005-2006	1	0	1

[a] Includes illegal kills.

Source: Young 2007.

Table 5.3. Reported moose harvest, by residency, in GMUs 20A and 20C, 1995-2005.

Year	Local resident hunters	Nonlocal resident hunters	Non-resident hunters	Total Harvest[a, b]
GMU 20A[c]				
1994-1995	270	67	45	399
1995-1996	390	68	64	526
1996-1997	427	102	73	607
1997-1998	406	110	98	619
1998-1999	367	131	108	608
1999-2000	369	153	129	657
2000-2001	326	138	73	541
2001-2002	350	131	56	539
2002-2003	190	77	85	353
2003-2004	185	68	78	331
2004-2005	191	95	92	393
GMU 20C[c]				
1995		131	9	152
1996		108	9	121
1997		114	9	123
1998		125	17	143
1998-1999	87	39	14	140
1999-2000	98	21	13	132
2000-2001	87	31	13	131
2001-2002	89	36	16	141
2002-2003	85	34	12	131
2003-2004	59	36	10	105
2004-2005	66	23	8	9

[a] Includes reports with 'unknown' residency.

[b] Excludes hunters in permit hunts.

[c] GMU 20C report does not differentiate between local and non-local hunters for all years.

Source: Young 2006; Seaton 2006.

Table 5.4. Black bear harvest, GMUs 20A and 20C, 1996-2004.

Year	GMU 20A Harvest	GMU 20C Harvest
1996-1997	58	41
1997-1998	60	35
1998-1999	57	48
1999-2000	50	46
2000-2001	58	46
2001-2002	48	21
2002-2003	46	39
2003-2004	35	18

[a] Includes bears killed in defense of life or property.

Source: Seaton 2005.

Table 5.5. Reported Dall sheep harvest, by residency, GMU 20A, 1995-2002.

Year	Local resident hunters	Nonlocal resident hunters	Nonresident hunters	Total Harvest[a]
1995-1996	26	5	27	60
1996-1997	18	11	24	54
1997-1998	13	7	25	45
1998-1999	14	5	24	44
1999-2000	15	11	24	51
2000-2001	4	8	15	27
2001-2002	10	6	31	50
2002-2003	14	8	43	68
2003-2004	23	7	37	67

[a] Includes reports with unknown residency

Source:Young 2005

Table 5.6. Furbearer harvest, GMU 20A and 20C, 2000-2007.

	Year						
GMU	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
Beaver[a]							
20A	35	94	53	--	--	--	--
20C	70	136	59	--	--	--	--
Lynx							
20A	440	628	295	118	116	98	116
20C	135	267	156	83	48	65	68
River Otter							
20A	20	16	16	7	6	4	6
20C	6	4	14	13	15	5	3
Wolverine							
20A	22	9	15	11	11	6	6
20C	7	15	16	5	11	10	11

[a] Sealing not required for beaver after June 2002.

Source: Selinger 2001; Seaton 2007.

2005, when populations decreased (Table 5.6). The reported beaver harvest in GMUs 20A and 20C has declined in recent years. The price per pelt has also declined over this time period, thus the decreasing reported harvest is likely due to decreased trapping effort and not a population decline (Selinger 2001).

3. Sport Fishing

Resident and non-resident anglers harvest several species of anadromous and resident fish in the license area. Because the Nenana River is glacially fed, not much sport fishing takes place on the main channel. Clear water tributaries to the Nenana River, however, can provide good fishing. Julius

Creek, Wood Creek, and Clear Creek are tributaries adjacent to the license area that are popular for sport fishing (ADF&G 2004).

In 2007, 414 anglers spent a total of 553 angler-days fishing within the Nenana River drainage (Table 5.7). In 2007, 440 Arctic grayling were harvested; few other fish were harvested (ADF&G 2007).

D. Transportation Corridor

The Alaska Railroad was constructed from 1917 to 1923, and runs through the middle of the license area, paralleling the Nenana River and Healy Creek. The communities of Cantwell, Mt. McKinley, Healy, and Ferry were all originally railroad stops and communities. It was owned by the federal government until 1985 when the state of Alaska purchased it and formed the Alaska Railroad Corporation (AARC). The AARC owns land in the area of the exploration license.

The Alaska Railroad is now a major transportation and communication corridor in the state, with 82 percent of the state's population living along the rail belt. Hauling gravel, export coal, fuel, tourists, lumber, and general freight, the Alaska Railroad is a vital link to the state's economy. The railroad provides industry with a safe and cost-effective way of transporting goods in and out of the state.

Table 5.7. Estimated sport fish harvest and effort for the Nenana River drainage (excluding Brushkana Creek), 2000-2007.

	Year							
	2000	2001	2002	2003	2004	2005	2006[a]	2007
Anglers	532	387	501	474	615	503	556	414
Trips	1,049	868	910	671	423	859	679	486
Days Fished	1,183	1,195	1,243	1,158	1,038	1,163	1,296	553
Chinook Salmon	24	0	0	11	0	0	16	0
Coho Salmon	6	118	24	11	78	0	37	0
Chum Salmon	0	0	0	0	0	0	0	9
Lake Trout	55	22	0	0	0	0	0	0
Dolly Varden	0	231	0	131	133	0	103	0
Rainbow Trout	0	0	0	0	0	0	0	0
Arctic Grayling[b]	144	112	187	373	66	488	248	251
Arctic Grayling[c]	153	30	119	82	90	1,131	216	189
Whitefish	0	0	0	0	0	0	12	0
Sheefish	0	0	6	0	31	0	0	0
Northern Pike[d]	0	99	20	0	167	0	0	0
Northern Pike[e]	0	13	0	0	0	0	0	0
Burbot	36	0	155	0	0	0	13	0

[a] 2006 estimates include Brushkana Creek.

[b] Arctic grayling less than 12 inches.

[c] Arctic grayling 12 inches and over.

[d] Northern pike 30 inches and under.

[e] Northern pike over 30 inches.

Source: ADF&G 2007.

E. Mining

Gold and coal resources in the area were originally identified and mapped as early as 1903-1911 and early settlement was associated with mining. Commercial coal production from the area has been continuous since 1916 and has produced an estimated 50 million tons from the area. Historic coal mining operations have occurred in the Healy Creek, Lignite Creek, and Black Diamond (Otto Lake) areas.

The UCM has operated for over 60 years in the area, since 1943, and currently has over 37,000 acres of ADNR issued coal leases in the license area. These include four permitted mine sites. Extensive infrastructure and facilities exist in support of these operations including numerous roads and trails, maintenance and office facilities, crushing and load-out facilities, and related power plants, power lines and interties, and railroad lines and spurs. UCM produces subbituminous coal, which is generally considered a soft coal and has a lower moisture content and higher heat content than lignite. Subbituminous coal is typically used in electricity generation.

UCM currently has a work force of about 100 employees, and operates year-round. Mine production has grown from 10,000 tons to an average 1.5 million tons of coal per year. Currently the only operational coal mine in Alaska, UCM supplies coal to six Interior Alaska power plants and exports coal to South Korea and several other Pacific Rim destinations (Usibelli 2009).

The Bonnifield Mining District has produced approximately 80,000 ounces of gold since 1903, predominantly from the western portion of the district located in the license area. Multiple lode and placer deposits exist with active claims, leases, and operations. ADNR's Division of Geological and Geophysical Survey has an ongoing priority project for the geophysical and geologic mapping of the historic Liberty Bell mine region of the license area located east of Ferry.

Many of the existing roads and trails in the license area were originally established to access mining areas. These include the Ferry and Rex trails into the Bonnifield Mining District and the Stampede Trail into the Kantishna Mining District. The Stampede Road was constructed in 1961 under the state's Pioneer Road Program to support the transportation of minerals from the Stampede antimony mine to the Alaska Railroad. Upon completion, the road received no maintenance and degraded rapidly. Antimony mining at the Stampede Mine ceased in 1970.

F. Tourism

Tourism generates the greatest number of jobs in the Denali Borough, driven by Denali National Park and Preserve. Over its history, Denali National Park and Preserve has attracted steadily increasing numbers of visitors. Since 1980, visitation beyond mile 15.0 of the park road (the end of the pavement and general public access) has increased three-fold. Although many independent travelers visit the park, the majority of tourists to the park arrive as part of package tours sponsored by the cruise ship industry (Denali Borough 2009).

As a result of increasing visitation, the area has seen an increase in the number of hotels and other accommodations. In 1980 there were a total of 133 hotel rooms near the park entrance. By 2000, the number of rooms near the park entrance had risen to 1,800 (Fried and Windisch-Cole 2001). Other accommodations include nearly 1,000 cabins and RV spaces. The borough imposes a bed tax, which provides nearly 86 percent of its yearly revenue (Fried and Windisch-Cole 2001).

Barriers to increasing tourism in the area have been attributed to the carrying capacity of DNPP. The park's carrying capacity sets the maximum acceptable level of road traffic that the park can endure without a negative impact. Denali counted 458,308 visitors in 2007 and 432,309 in 2008. Faced with increasing visitation and pressure to defend or change the limits to road traffic, park managers have designed a multidisciplinary study to develop a greater understanding of the impacts of traffic

volume and traffic patterns on the physical, biological, and social environment of the park (NPS 2009).

While the NPS considers options to expand tourism opportunities within DNPP, other groups are looking at ways to improve and expand tourist opportunities outside the park boundaries, in Nenana Canyon and Healy. Nenana Canyon, located just outside the entrance of the park where the park road intersects the George Parks Highway, is a collection of seasonal tourist facilities. Many shops, restaurants, and several large hotel complexes are located in the canyon. Several rafting companies run trips on the Nenana River, from Nenana Canyon. Visitation facilities are also expanding in Healy, with activities such as dogsledding and horseback riding available, and accommodations range from bed and breakfast to cabin rentals (Denali Chamber of Commerce 2009).

G. References

ADF&G (Alaska Department of Fish and Game)
2004 Tanana River drainages sport fish harvest and effort by fisheries and species. http://www.sf.adfg.state.ak.us/Statewide/ParticipationAndHarvest/main.cfm Accessed February, 2009.

ADF&G (Alaska Department of Fish and Game)
2005 Alaska subsistence fisheries 2003 annual report. Alaska Department of Fish and Game, Division of Subsistence, Juneau. http://www.subsistence.adfg.state.ak.us/download/asf2003.pdf

ADF&G (Alaska Department of Fish and Game)
2007 Personal communication from Mark Fink, Habitat Biologist, Division of Sport Fish, Anchorage to Allison Iverson, DO&G. June 6, 2007.

ADNR (Alaska Department of Natural Resources)
1991 Tanana Basin Area Plan for State Lands. ADNR, Fairbanks, AK.

Denali Borough
2009 Website. http://denaliborough.govoffice.com/ Accessed 3/14/09.

Denali Chamber of Commerce
2009 Visiting Denali. http://denalichamber.com/index.php Accessed 4/14/09.

Fall, J. A., R. T. Stanek, B. Davis, L. Williams and R. Walker
2004 Cook Inlet customary and traditional subsistence fisheries assessment. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fishery Information Services Division, Federal Subsistence Monitoring Program Final Project Report No. FIS03-045, Anchorage. http://alaska.fws.gov/asm/pdf/fisheries/reports/03-045final.pdf

Fried, N. and B. Windisch-Cole
2001 The Denali Borough. Alaska Economic Trends, Alaska Department of Labor and Workforce Development. http://labor.state.ak.us.trends/trendspdf/sep01/pdf

NPS (National Park Service)
2009 Denali park road capacity study. http://www.nps.gov/dena/naturescience/denali-park-road-capacity-study.htm Accessed April 2009.

Seaton, C. T.
2005 Units 20A, 20B, 20C, and 20F black bear management report. *In* Black bear management report of survey and inventory activities 1 July-30 June 2004. C. Brown, editor. Pages 223-247. Project 17.0, Alaska Department of Fish and Game. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/05blbweb.pdf

Seaton, C. T.
2006 Units 20C, 20F, and 25C moose management report. *In* Moose management report of survey and inventory activities 1 July 2003 through 20 June 2005. P. Harper, editor. Pages 363-376. Project 1.0, Alaska Department of Fish and Game. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/06_moose.pdf

Seaton, C. T.
2007 Units 20A, 20B, 20C, 20F, and 25C furbearer. *In* Furbearer management report of survey and inventory activities 1 July 2003 - 30 June 2006. P. Harper, ed. Pages 240-257 Alaska Department of Fish and Game. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/07_fur.pdf

Selinger, J.
2001 Unit 20 and 25 furbearer management report. Pages 260-275 *in* C. Healy, editor. Furbearer management report of survey and inventory activities 1 July 1997 - 30 June 2000. Alaska Department of Fish and Game, Project 7.0. Juneau, Alaska. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/fur01mt_in.pdf

Simeone, W. E.
2002 Wild resource harvests and uses by residents of Cantwell, Alaska 2000. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 272, Juneau. http://www.subsistence.adfg.state.ak.us/TechPap/tp272.pdf

Usibelli
2009 Usibelli Coal Mine. http://www.usibelli.com Accessed 4/14/09.

Young, D. D.
2005 Unit 20A Dall sheep management report. Pages 110-120 *in* C. Brown, editor. Dall sheep management report of survey and inventory activities. Alaska Department of Fish and Game, Juneau, Alaska. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/sh05mt.pdf

Young, D. D.
2006 Unit 20A moose management report. Pages 322-343 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003-30 June 2005. Alaska Department of Fish and Game, Juneau, Alaska. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/sh05mt.pdf

Young, D. D.
2007 Unit 20A, 20B, 20C, 20F, and 25C brown bear. Pages 212-228 *in* P. Harper, editor. Brown bear management report of survey and inventory activities 1 July 2004-30 June 2006. Alaska Department of Fish and Game, Juneau, Alaska. http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/07_brbear.pdf

Chapter Six: Gas in the Healy Basin Exploration License Area

Table of Contents

List of Tables

List of Map

Chapter Six: Gas in the Healy Basin Exploration License Area

A. Geology

The license area comprises the northern portion of the Healy quadrangle and the southern portion of the Fairbanks quadrangle. Both the Healy and Fairbanks quadrangles are underlain by a variety of sedimentary, volcanic, and plutonic rocks ranging in age from Precambrian to Holocene (Csejtey et al. 1992; Pewe et al. 1966). Pre-Cenozoic rocks in the Healy quadrangle are intensely deformed by thrusting and folding (Csejtey et al. 1992). This deformation is due to the mid-Cretaceous collision and subsequent obduction of the northward-moving Talkeetna subterrane with and onto the Yukon-Tanana and Nixon Fork terranes of the ancient North American Continent. Late Cenozoic deformation, the result of continued northward plate motion, has modified but not substantially altered the geology of the quadrangle (Csejtey et al. 1992). The license area is within the Healy quadrangle and is on the Yukon-Tanana terrane.

Unconsolidated deposits surround the Nenana River, with outlying areas of the license area dominated by Nenana gravel, coal bearing formation, and Totatlanika schist (Csejtey et al. 1992; Pewe et al. 1966). The coal bearing rocks are unconsolidated and cover a great range in thickness. Within the Nenana coal field, the total maximum thickness of coal bearing rocks does not exceed 3,000 ft or approximately 900 m (Csejtey et al. 1992). Some coal seams in the Nenana coal field reach 65 ft (20 m) thick, however most coal seams have a maximum thickness of a few meters (Csejtey et al. 1992).

B. Petroleum Potential

The Healy Basin's greatest petroleum potential is for gas. Hydrocarbon potential is expected to be high for shallow coalbed methane (unconventional gas). The potential for discovery of conventional gas from the deeper basin is possible, but less likely. The potential for oil is low.

For an accumulation of hydrocarbons to be recoverable, the underlying geology must be favorable. Favorable geology depends on the presence of source and reservoir rock, the depth and time of burial, and the presence of migration routes or geologic traps or reservoirs. Source rocks are organic rich sediments such as marine shale, sandstone, or limestone, which have been buried for a sufficient time and with sufficient temperature and pressure to form hydrocarbons. As hydrocarbons in the sub-strata are formed, they progress toward the surface if a migration route exists, such as a permeable strata or fault fracture. An example of a migration route might be a permeable layer of rock in contact with the source layer, or fault fractures that penetrate organic rich sediments. A hydrocarbon reservoir is permeable rock that has been geologically sealed at the correct time to form a "trap." The presence of migration routes affects the depth and location of an oil or gas reservoir. A "play" is a geographically or stratigraphically delimited area where a specific set of geological factors such as reservoir rock, trap, mature source rock, and migrations paths may be found.

Methane (CH_4) is the primary component of natural gas; coalbed methane is the same compound as the methane found in natural gas. There are two types: biogenic methane, produced during microbial decay of peat (also called swamp gas) and thermogenic methane, produced by the thermal cracking of the organic molecules during the formation of higher ranks of coal. Coalbed methane is found in coal seams, which serve as both the source and reservoir for the methane. Methane is generated either from a biological process as a result of microbial action or through coalification (the thermal process wherein coal is exposed to increasing heat and increasing burial depth, over time). Because coal has such a large internal surface area, it can store surprisingly large volumes of methane-rich

Table 6.1. Geologic time.

Era	Period	Epoch	Age (Millions of years)
Cenozoic	Quaternary	Holocene	0.01
		Pleistocene	1.8
	Tertiary	Pliocene	5.3
		Miocene	23.0
		Oligocene	33.9
		Eocene	55.8
		Paleocene	65.5
Mesozoic	Cretaceous	Early to Late	145.5
	Jurassic	Early to Late	199.6
	Triassic	Early to Late	251.0
Paleozoic	Permian	Early to Late	299.0
	Pennsylvanian	Early to Late	318.1
	Mississippian	Early to Late	359.2
	Devonian	Early to Late	416.0
	Silurian	Early to Late	443.7
	Ordovician	Early to Late	488.3
	Cambrian	Early to Late	542.0

Notes: Adapted from U.S. Geological Survey Geologic Names Committee, 2007, Divisions of geologic time--Major chronostratigraphic and geochronologic units (USGS 2007).

gas; six or seven times as much gas as a conventional natural gas reservoir of equal rock volume. The amount of methane stored within the coal can reach up to 500 cubic ft per ton. To be producible for methane, a coal seam must have sufficient fractures (cleats) to provide permeability for gas migration. Generally, a coal seam is saturated with water and water pressure holds the methane in the coal. Gas is produced by removing water to reduce formation pressure, thereby releasing the methane.

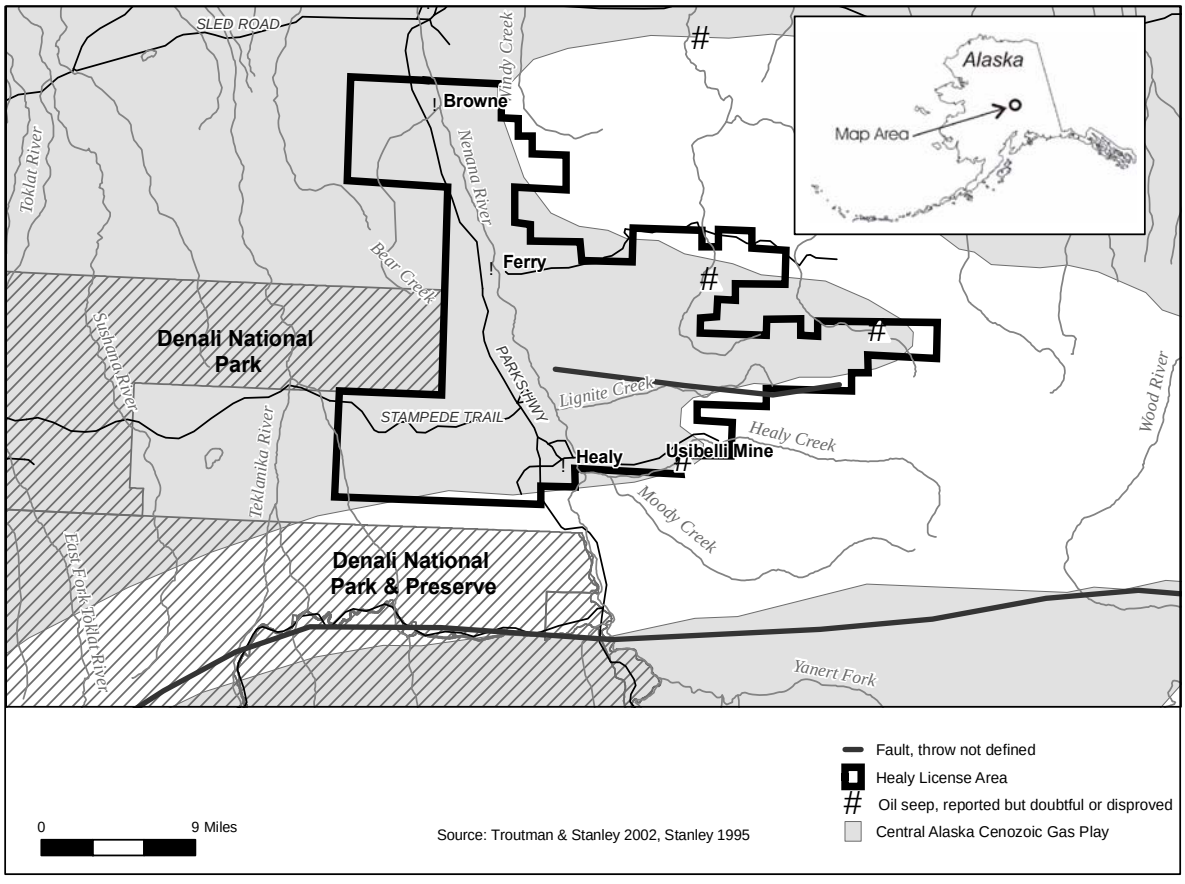
As shown in Map 6.1, the majority of the Healy Basin is a late Tertiary or Quaternary sedimentary basin (Troutman and Stanley 2002). Small portions of the license area are covered with basement rocks, and a fault with an undefined throw runs east to west through the license area. Oil seeps have been reported in three areas in and immediately adjacent to the license area. One seep was reported approximately 12-13 miles east of Ferry, along California Creek (Troutman and Stanley 2002). However, based on field investigations by the U.S. Geological Survey (USGS), this seep is regarded as doubtful (Miller et al. 1959). A second seep was reported approximately 7-8 miles east of Healy in the Nenana coal field along Healy Creek. This seep was determined to be a natural tar produced by distillation from burning coal beds (Miller et al. 1959).The third seep reported in the area was located approximately 15-20 miles northeast of Healy in the Nenana coal field. This seep is also regarded as doubtful based on field investigations by the USGS (Miller et al. 1959).

The Healy Basin's greatest petroleum potential is for natural gas. Cenozoic basins in central Alaska potentially contain accumulations of dry gas in mildly deformed, non-marine, coal bearing strata (Stanley 1995). The Alaska Cenozoic gas play is a hypothetical gas play identified in the 1995 National Oil and Gas Assessment of the Central Alaska Province (Stanley 1995), which includes the

Healy Basin. This play contains the potential source rocks coal and non-marine organic-rich mudrocks, potentially containing methane from biologic generation (Stanley 1995). Stanley (1995) also identifies the possibility of thermogenic gas buried in Tertiary strata near Cenozoic intrusions.

Very little subsurface geological information is available within the Healy Basin exploration license area, and there is no documentation available quantifying the occurrence of hydrocarbons, either gas or oil, within the license area. However, the presence of a significant volume of subbituminous C rank coal within the license area and adjacent sedimentary basins, as well as observed gas seeps, suggests the high probability that shallow biogenic gas is present. This shallow biogenic gas is generated by and sequestered within the coal beds and juxtaposed reservoir quality sediments. Locally generated thermogenic methane may be near Oligocene to Paleocene igneous intrusions. Possible, but less likely, is the presence of thermogenic natural gas that has migrated up-dip from the deeper Middle Tanana Basin into shallow stratigraphic traps within the license area. It is not known whether the gas is of sufficient quantity to be commercially developable.

Exploration licensing supplements the state's conventional oil and gas leasing program by targeting areas outside known oil and gas provinces. The intent of exploration licensing is to encourage exploration in areas with relatively low or unknown hydrocarbon potential where there is a higher investment risk to the operator. There are benefits besides taxes and royalties from exploration licensing, particularly, the state receives valuable subsurface geologic information on areas with relatively low or unknown petroleum potential.



Source: Troutman and Stanley 2002; Stanley 1995.

Map 6.1. Petroleum potential in the license area.

C. Phases of Natural Gas Development

License and lease-related activities proceed in phases. After issuance of an exploration license, there are three phases of industrial activity: exploration, development, and production. Subsurface storage may be an additional phase. Only exploration may occur under a license. Various activities may occur at each of these phases, depending on the specifics of a project, and each subsequent phase's activities depend on the initiation or completion of the preceding phase. Table 6.2 lists activities that may occur during these phases.

Until discoveries are made, it is impossible to predict the potential level of associated activities and their effects. Implementation of any exploration, development, or development program must meet a myriad of requirements of regulatory agencies prior to approval. Permit requirements must be evaluated in light of the particular activity proposed, and plans of operation must be conditioned with appropriate project-specific and site-specific safeguards.

Generally, the process for evaluating a prospect is lengthy. It may involve shallow geophysical surveys, core hole test wells, pilot projects, water disposal plans, field development, and gas transportation. Each stage requires a separate review by a variety of governmental agencies, public commenting periods, and permitting processes.

Table 6.2. Potential activities during exploration, development, and production phases.

Exploration	Development	Production
Permitting	Gravel pits, pads, and roads	Well work over (rigs)
Water usage	Drilling rigs	Gravel pads and roads
Environmental studies	Pipelines	Produced water
Seismic tests	Bridge construction	Air emissions
Exploratory drilling rigs	Permitting	Pipeline maintenance
Land clearing	Monitoring	Trucking
Drilling muds and discharges	Well heads	
Gravel road beds	Re-injection wells	
Temporary gravel pads	Seismic	
Research and analysis	Air emissions	
Air emissions	Work camps	
Work camps		

1. The Exploration License Phase

The exploration license will grant UCM the exclusive right to explore for gas within the license area (AS 38.05.132). The license is limited to gas only; if oil is discovered, UCM must contact DO&G for further consultation. The license will have a maximum term of 10 years, unless terminated. There is a non-refundable fee of $1 per acre.

UCM's license will be conditioned on a specific work commitment of spending $500,000 over the 10-year term of the license. UCM must complete at least 25% of that commitment, $125,000, by the fourth anniversary of the license and must post bond and renew it annually. Expenditures for the

work commitment are cash expenses such as labor costs, equipment, materials, supplies, and contractors, with the goal of gathering exploration data or drilling one or more exploration wells.

Exploration activities may include the following: examination of the surface geology, geophysical surveys (see next section), performing environmental assessments, and drilling one or more exploratory wells. Surface analysis includes the study of surface topography or the natural surface features of the area, near-surface structures revealed by examining and mapping exposed rock layers, and geographic features such as hills, mountains, and valleys.

Issuance of the license is independent of permits required for exploration activities. A land use permit from ADNR is required for geophysical exploration (11 AAC 96); see the next section.

a. Geophysical Exploration Phase

Geophysical surveys help reveal what the subsurface may look like. Seismic surveys are the most common type of geophysical exploration. Licensees usually contract with geophysical companies to conduct these surveys. Geophysical exploration activities are regulated by 11 AAC 96, and ADNR tailors each permit approval to the specifics of a proposed project. Restrictions imposed via geophysical exploration permits depend on the duration, location, and intensity of the project. They also depend on the potential effects the activity may have on vegetation, fish, and wildlife resources or human use in the area. The extent of effects varies, depending on the survey method and the time of year the operation is conducted.

To gather seismic data, an energy source is emitted into the subsurface and reflected energy waves are recorded by vibration-sensitive receivers called geophones. Impulses are recorded, processed on high-speed computers, and displayed in the form of a seismic reflection profile. Different densities of rock layers beneath the surface result in a unique seismic profile that can be analyzed by geophysicists to determine subsurface structures and petroleum potential. Both two-dimensional (2D) and three-dimensional (3D) data are gathered from seismic surveys.

To conduct a seismic survey, source and receiver locations are surveyed using GPS (Global Positioning Systems) and laid out in predesigned patterns. For 2D data, the receivers and sources lie in as straight a line as possible given the terrain, and can extend for many tens of miles. For 3D data, data is collected over a much wider swath, and can cover tens to hundreds of square miles. 2D seismic programs usually have fewer crewmembers and employ much less equipment than 3D programs.

Land-based seismic surveys are usually conducted in winter to minimize effects to fish and wildlife habitats. In areas of high habitat sensitivity, such as wildlife and game refuges, heli-portable crews and/or backpackers are used to transport equipment. In more accessible areas, narrow tracked vehicles are used for transport. If needed to facilitate access, mulchers are used to clear brush, small alders and willows in 2-3 m wide paths. Mulchers are not used in old growth or larger trees. Surveys now use global satellite positioning instruments, making the past practice of long clear-cuts through forests for line-of-sight measurements unnecessary.

Multiple seismic sources can be used on land surveys, based on the terrain and conditions, including explosives, weight drop, and hydraulic devices (vibrator trucks). Explosives may be placed into drill holes and detonated, or, much less commonly, they may be suspended on stakes above the ground (Poulter method). When buried, drill holes are typically 20-30 ft deep with 2.5-5 lb of explosives set at the bottom of the hole. Holes are either drilled with track-mounted drills or, if in remote or sensitive areas, drills are slung into position by helicopters. Soil is disturbed in the immediate vicinity of the explosive charges placed into the ground. At locations with existing developments, allowable maximum peak particle velocity is mapped and if explosives are contra-indicated, vibrators or a weight drop are used to produce the seismic wave energy.

Vibroseis, a more common practice, utilizes a vibrator as the energy source. A vibrating plate is attached to a low ground pressure vehicle and creates a vibration of continuously varying frequency to put energy into the ground, typically lasting four seconds or longer. This method is less destructive than an impulsive explosive source, where all the energy is imparted in an instant.

Finally, a weight drop method can be used. The weight drop mechanism is transported via narrow tracked vehicles and is becoming a more routine acquisition source. Depending on the location, terrain and varying vegetation cover, several energy source techniques might be needed for the same project.

b. Drilling Exploratory Gas Wells

Exploratory drilling may occur under a license and under a lease. It often occurs after seismic surveys are conducted, and when the interpretation of the seismic data incorporated with all available geologic data indicates gas prospects. Exploration drilling, which proceeds only after obtaining the appropriate permits, is the best way to learn whether a prospect contains commercial quantities of gas, and aids in determining whether to proceed to the development phase. Drilling operations collect well logs, core samples, cuttings, and a variety of other data. A well log is a record of one or more physical measurements as a function of depth in a borehole and is achieved by lowering measuring instruments into the well bore. Well logs can also be recorded while drilling. Cores may be cut at various intervals so that geologists and engineers can examine the sequences of rock that are being drilled.

The drill site is selected to provide access to the prospect and is located to minimize the surface area that may have to be cleared. Sometimes temporary roads must be built to the area. If gas is discovered at the exploratory well, it is likely that the gravel pad used for the exploratory well will also be used for development and production operations. Gravel pads are semi-permanent structures and can be rehabilitated following field depletion.

The drilling process is as follows:

- Special steel pipe (conductor casing) is bored into the soil.
- A drill bit, connected to the end of the drill pipe, rotates and drills a hole through the rock formations below the surface.
- Blowout preventers are installed on the surface and only removed when the well is plugged and abandoned. Blowout preventers are large, high-strength valves, which close hydraulically on the drill pipe to prevent the escape of fluids to the surface.
- After a prescribed depth of drilling, the hole is cleaned up and surface casing, a smaller diameter steel pipe, is lowered into the hole and cemented in place to keep the hole from caving in; seal off rock formations; seal the well bore from groundwater; and provide a conduit from the bottom of the hole to the drilling rig.
- After surface casing is set, drilling continues until the objective formation is reached. In instances where subsurface pressures are extremely high, an intermediate casing string may be lowered into the hole and cemented in place.
- The well is put into production, capped, or plugged and abandoned. (Before development or production may take place, the license must be converted to a lease.)

Drill rigs must have three sensing points for detection of methane and a fourth may be required over a mud pit (20 AAC 25.066).

Rock fragments (drill cuttings) are produced during the drilling of the borehole. Drilling fluids (muds) are used to circulate the cuttings out of the hole. Typically, muds used to drill coalbed

methane wells do not contain hazardous materials. During drilling operations, the cuttings are separated from the drilling muds and disposed of. The muds may be re-circulated or disposed of.

Operators may store drilling solids and fluids in tanks or in temporary on-pad storage areas until they can be disposed of. The state discourages the use of reserve pits, but if a reserve pit is necessary, it is constructed off the drill pad and could be as large as 5 ft deep and 40 ft by 60 ft. It is lined with an 80 mil geotextile liner to prevent contamination of surrounding soils. If necessary, a flare pit may be constructed off the drill pad to allow for the safe venting of natural gas that may be encountered in the well.

Disposal of muds, cuttings, and other effluents is regulated by the National Pollutant Discharge Elimination System (NPDES) and the EPA's Underground Injection Control program administered by the Alaska Oil and Gas Conservation Commission under regulations in 20 AAC 25. Muds and cuttings are often disposed of by reinjection into an approved disposal well annulus or disposal well, which must be permitted in accordance with 20 AAC 25.080 and 20 AAC 25.252. With appropriate permits, solids may be left in place in a capped reserve pit. Drilling solids and fluids may also be shipped to a disposal facility out-of-state. Mitigation measures in Chapter Nine of this finding address storage and disposal of muds and cuttings.

If the exploratory well is successful, the operator may drill additional wells to delineate the extent of the discovery and gather more information about the field. The licensee needs to know the quantity of gas, and the quality of the rocks or coal in which it is found, to determine whether to proceed to convert to a lease, and whether to proceed with further exploration and/or the development phase.

c. Drilling Exploratory Coalbed Methane Wells

In addition to exploring for and producing conventional gas, the exploration license also allows the licensee to explore for nonconventional gas resources such as coalbed methane. Production of coalbed methane, a possible product in the license area, is accomplished through both vertically and horizontally drilled wells, much like those described above.

Exploratory wells are constructed in order to extract the subsurface resource and assess its actual size. Depending on the projected size of the field, more than one pilot project could be necessary to adequately evaluate the prospect.

Three major concerns are addressed in the process of drilling a coalbed methane well: 1) safety; 2) structural integrity; and 3) protection of groundwater aquifers. To ensure all three concerns are properly addressed, the well is drilled in stages, and the diameter of the well bore becomes progressively smaller with depth. As each well bore diameter is drilled, casing is installed in the borehole, and the casing is cemented in place.

A typical CBM well begins with the drilling of a 14-in hole to a depth of 60 to 80 ft. A 12-in conductor pipe is installed to the bottom of the hole with the joints welded and the entire length cemented in place. This provides a stable conduit into the ground, prohibiting shallow ground water and unconsolidated sediments of the surface from slumping into the hole.

An 8-in hole is then drilled to a depth of approximately 300 ft, usually 50 to 100 ft into bedrock. A 6-in surface casing is then cemented in place from the top of the conductor pipe to the bottom of the hole. This provides a structural base for mounting a blow-out-preventer (BOP). The operator uses a BOP to shut-in the well should an unanticipated subsurface pressure be encountered, thereby reducing the possibility of a loss of well control and gas release to the environment. After the surface casing and BOP are installed it is safe to drill to the depth required for production.

Depending on the anticipated depth of the production zone, wells are usually drilled in one or two additional stages of diameter and depth. Typically, a 5-in hole is drilled to approximately 3,000 ft and a 4-in casing is cemented in place from the surface to the total depth of the well.

The multiple layers of steel casing and cement are required to protect the groundwater aquifers and to eliminate the possibility of fluid migration between the confining layers of strata. The final step in drilling the well is to perforate the casing at the appropriate coal bed interval(s) to allow communication between the coal seam and the interior of the well bore.

After the well is drilled and perforated, the coal seam must be hydraulically fractured to allow the water and gas to flow freely into the well bore. This is accomplished by pumping fluid into the formation at a high enough pressure that it separates the structure causing linear cracks from the well outward. Typically, the fluid used is innocuous and contains sand or other permeable material that keeps the cracks open, yet allows the unrestricted flow of water and gas.

2. Conversion to a Gas Lease

If the licensee, UCM, meets the work commitment, UCM may request conversion of the license to gas only leases. The leases will be subject to a production royalty of 12.5% and an annual rental of $3 per acre until the state's royalty income exceeds rental income. A gas only lease is for a maximum period of 10 years and is automatically extended if, and for so long as, gas is produced in paying quantities from the lease or if the lease is committed to a unit.

Conversion to a lease is independent of permits required for further exploration and subsequent development and production. Each stage of the permitting process includes opportunities for public participation. If the license is converted to a lease, further exploration may occur, with either or both geophysical exploration or drilling one or more wells.

3. Development and Production Phases

The development and production phases are interrelated and overlap in time; therefore, this section discusses them together. During the development phase, operators evaluate the results of exploratory drilling and develop plans to bring the discovery into production. Production operations bring natural gas to the surface and prepare it for transport to the processing plant or compressor station. These phases can begin only after exploration has been completed and tests show that a discovery is economically viable (Gerding 1986).

After designing the facilities and obtaining the necessary permits, the operator constructs permanent structures and drills production wells. The operator must build production structures that will last the life of the field and may have to design and add new facilities for enhanced recovery operations as production proceeds. Completing a well includes strengthening the well hole with casing, evaluating the pressure and temperature of the formation, and then installing the proper equipment to ensure an efficient flow of natural gas out of the well (NGSA 2009). The most visible part of a well is the Christmas tree, the tubes and valves that control the flow of natural gas out of the well.

Production operations for natural gas generally follow these steps:

- Natural gas flows through a high-pressure separator system where any liquids (water, condensate, etc.) are removed.
- The gas is compressed, if necessary, to help push it through the pipeline.
- The gas is dehydrated to lower its water content.
- The gas is then metered, i.e. the amount of gas produced is measured.
- The gas is transported to a facility where it passes through a water precipitator to remove any liquid.
- The gas may be conditioned or treated prior to transportation. Gas may be converted into liquefied natural gas (LNG).

Gravel pads are semi-permanent structures used for production facilities and can be rehabilitated following field depletion. The development "footprint" has decreased in recent years as advances in drilling technology have led to smaller, more consolidated pad sizes. Directional drilling (Appendix C) allows more wells to be drilled from a common location (drill pad). A single production pad and several directionally drilled wells can develop more than one and possibly several 640-acre sections. Sometimes a well is drilled at an angle through a formation to increase productivity and allow the gas to be extracted from a larger subsurface area (by increasing the drainage area) than would be possible from a single straight wellbore.

The Alaska Oil and Gas Conservation Commission, through its statutory and regulatory mandate, oversees drilling and production practices to maximize gas recovery, prevent waste, and ensure protection of correlative rights within the state. It is a quasi-judicial agency that conducts hearings to review drilling and development to ensure regulatory compliance.

Natural gas is occasionally flared for safety reasons. Flaring is "the controlled burning of natural gas at a well site or facility; venting is the release of uncombusted natural gas to the atmosphere" (Centre for Energy 2008). However, operators in Alaska are required to minimize the volume of gas released, burned, or permitted to escape into the air (20 AAC 23.235(c)). Operators must report monthly to AOGCC any flaring event lasting over an hour. AOGCC investigates these incidents to determine if there was unnecessary waste. For additional discussion about air quality regulations and AOGCC, see Section C of this chapter, and Chapter Seven.

AOGCC may issue Conservation Orders (pool rules) to grant exceptions to regulations conditioned on prevention of waste, maximizing ultimate oil and gas recovery. Where gas has been discovered, not more than one well per section may be drilled into the pool. A producer may apply to change the spacing requirements if there is technical justification to support greater ultimate recovery by changing the spacing requirements. A Conservation Order will grant exception to regulations under 20 AAC 25 upon finding and concluding the spacing exception will not cause waste.

The natural gas used to heat homes is almost entirely methane; when produced, though, gas may contain water and other substances. Natural gas transported through pipelines must meet purity specifications before being allowed in, so most natural gas processing occurs near the well (NGSA 2004).

At the best interest finding phase it is impossible to predict what a full development scenario will entail. The final project parameters will depend on the surface location, size, depth, and geology of a specific commercial discovery.

a. Producing Coalbed Methane

Production of coalbed methane is accomplished through both vertically and horizontally drilled wells, much like those drilled to produce conventional natural gas and petroleum. In addition, much of the coal, and thus much of the methane, lies at shallow depths, making these wells relatively easy to drill and inexpensive to complete. The amount of gas that can be produced from a given coal bed depends on the following factors:

- The thickness, lateral continuity and rank of the coal;
- The permeability, which is controlled by the amount of fracturing or cleats;
- Depth of burial and other barriers, such as impermeable layers, structures, and faults or folds, that keep the gas trapped within the coal seam.

Coal seams not only contain methane, they also contain water, which is under pressure and keeps the gas trapped in the coal. To produce coalbed methane, enough water is removed (pumped) to reduce the hydrostatic pressure and allow the gas to detach from the coal and flow up the well. Some coals

may never produce methane if the hydrostatic pressure cannot be efficiently lowered. Some coal seams may produce gas, but are too deep to economically drill. Wells are typically no more than 5,000 ft in depth, although some deeper wells have been drilled (CBM 2004). Water may be pumped into the well to enlarge fractures in the coal, which facilitate production. Initially, wells produce mostly water, with the volume decreasing as production of gas increases. Depending on geological conditions, it may take several years to achieve full-scale gas production (NGSA 2009). The quality of this water varies, depending on the geology of the coal formation; some contain salts and hazardous substances.

The most common way coalbed methane wells are de-watered is by using a hydraulic sub-surface lift system. This system utilizes a hydraulically driven power head mounted at the top of the well that spins a rod connected to a pump assembly at the bottom of the well. The amount of time it takes to de-water a coal seam adequately to allow the methane to be released is influenced by a variety of subsurface factors: coal characterization, amount and flow of ground water, and geologic faults and traps to name a few. As the pressure is reduced, the gas is released from the coal. The methane molecules flow through the matrix of the coal until they reach the natural micro fractures or "cleats" found in the coal. Gas accumulates in the cleats and flows to the well with the water.

Water may be pumped using an electric pump mounted at the wellhead or by a submersible pump in the bottom of the well casing. Eventually the well may supply enough gas to run the generator. Until that time, any small amount of gas produced will be vented into the atmosphere.

To facilitate the movement of gas to wells, highly pressured materials are sent into the seam to create fractures. This is called "fracturing" the coal. Geologic structures and localized faulting induce natural fracturing, which increases production pathways, just as fracturing materials do. Natural fracturing contributes to lower production costs (CBM 2004).

4. Subsurface Gas Storage Phase

Under AS 38.05.180(u), the Commissioner of ADNR may authorize the subsurface storage of oil or gas to avoid waste or to promote conservation of natural resources. In Alaska, depleted reservoirs with established well control data are preferred storage zones. By memorandum dated September 2, 2004, the Commissioner approved a supplement to Department Order 003 and delegated the authority to authorize subsurface storage of oil or gas to the Division of Oil and Gas Director.

A subsurface storage authorization allows the storage of gas and associated substances in the portions of the gas storage formation, subject to the terms and applicable statutes and regulations, including mitigation measures and advisories incorporated by reference into the authorization. It does not matter whether the gas is produced from state land, so long as storage occurs in land leased or subject to lease under AS 38.05.180. A gas lease on which storage is authorized shall be extended at least for the period of storage and so long thereafter as oil or gas not previously produced is produced in paying quantities. The feasibility of subsurface storage depends on favorable geological and engineering properties of the storage reservoir, including its size and its gas cushion (or base gas requirements). It also depends on access to transportation, pipeline infrastructure, existing production infrastructure, gas production sources, and delivery points.

Subsurface storage must comply with all applicable local, state, and federal statutes and regulations, and with any terms imposed in the authorization or in any subsequent plan of operation approvals, or in the AOGCC Storage Injection Order. The plans of operation must identify the specific measures, design criteria, construction methods, and standards that will be employed to meet the provisions of the subsurface storage authorization. Plans of operation are subject to extensive technical agency review. They are also subject to consistency with the ACMP standards if the affected lands are within the coastal zone. The plans are available for public review upon submittal to the state. Oil and

gas storage-related activities will be permitted only if proposed future operations comply with all borough, state, and federal laws and the provisions of the authorization.

A storage authorization is for only specified sand horizons and does not grant the right to drill, develop, produce, extract, remove, or market gas other than injected gas. A storage authorization allows the overlying gas leases to continue as long as their original terms are met. Subsurface storage will be subject to terms and conditions identical to existing gas lease permitting and bonding requirements. Storage operations may not interfere with existing gas lease operations. Subsurface storage must comply with 20 AAC 25, specifically 20 AAC 25.252. Before any gas may be injected, approval of the Injection Order from AOGCC must be obtained.

Some unproduced "native" gas may remain in gas storage reservoirs and serve as "cushion gas" to support gas withdrawal and delivery rates. Cushion gas is the volume of gas intended as permanent inventory in a storage reservoir to maintain adequate pressure and deliverability rates throughout the withdrawal season. Royalty on this native cushion gas may be paid from a percentage of each year's annual gas withdrawal as if it were originally produced from the overlying oil and gas lease, and allocated according to the unit agreement. Injected gas will mix with native gas in the reservoirs. Royalty on the native gas within the gas storage formation under the leased area is computed at the royalty rate and paid at the value as specified in the applicable oil and gas leases.

ADNR may amend a subsurface storage authorization if stored gas migrates from the gas storage formation to other formations or if stored gas expands beyond the limits of the authorized area. DO&G shall be notified of any anticipated changes in the project resulting in alteration of conditions that were originally approved and further approval must be obtained before those changes are implemented.

Where gas has been discovered, not more than one well per section may be drilled into the pool. A gas producer may apply to change the spacing requirements if there is technical justification to support greater ultimate recovery by changing the spacing requirements. A Conservation Order will grant exception to regulations under 20 AAC 25 upon finding and concluding the spacing exception will not cause waste.

D. Gas Exploration, Development, and Production in the Healy Basin

Alaska has a long history of oil and gas exploration and development, principally in the Cook Inlet and North Slope regions. Interest in exploration for natural gas only and for coalbed methane is recent, and has at times been contentious. No exploration, development, or production, of either oil or gas, have occurred in the Healy area. UCM, the applicant, does have infrastructure to support coal mining operations. The Healy license area holds some promise for coalbed methane gas development and, possibly, conventional gas. Geologic conditions are not favorable for the presence of oil.

To date, there has not been an economical CBM development in Alaska although CBM has been developed in the Raton Basin of Colorado and New Mexico, and the Powder River Basin of Montana and Wyoming. However, there are important differences in the depth of both coal and water resources, between Alaska and these other states. The only recent CBM exploration and pilot project in Alaska is that of Evergreen Resources in the Matanuska-Susitna Valley, which was abandoned because local residents were concerned with the proximity of coalbed methane production to their homes, and feared losing their water and property rights (Balay 2003). As a result of the public process for the Evergreen Resources project, ADNR developed mitigation measures for CBM development within the Matanuska-Susitna Borough in 2004. Similar standards, adapted to the conditions of the Healy license area, are included as mitigation measures in Chapter Nine..

Coalbed methane exploration is occurring in other areas of Alaska. The Department of the Interior Alaska Rural Energy Project is a collaborative effort between BLM, USGS, ADNR, and other state, local, and private partners. The project's goal is to identify and assess shallow subsurface resources such as coalbed methane and geothermal, to replace diesel fuel. BLM, ADNR, and USGS are drilling test wells to investigate coalbed methane as an alternative to diesel fuel usage in rural Alaska. A test well drilled in the summer of 2007 in Wainwright indicated the presence of 1.24 billion cubic ft of gas in one square mile of just one subsurface coal seam (Bailey 2008). The 2007 tests indicate there is enough coalbed methane underlying Wainwright to serve as an alternative energy source for the community. A longer production test planned for 2009 will collect data to more fully define reservoir properties and evaluate production potential (Clark and Fisk 2008). Earlier, the project conducted exploratory drilling in Fort Yukon, again with the goal of providing a local source of natural gas. Although the Fort Yukon well encountered some thick coal seams, the gas content and permeability of the coal both turned out to be too low for practical gas production. (Bailey 2005).

Studies are underway to develop drilling technologies that have low environmental impacts. In March 2009, Houston Advanced Research Center, a nonprofit organization dedicated to sustainable development, and Texas A&M University announced a partnership with seven other U.S. universities to fund the research (Bailey 2009). The partnership is an offshoot of a U.S. Department of Energy National Energy Technology Laboratory-funded (NETL) project to identify and develop low-impact drilling systems.

Whether or not the license is converted to a lease, and whether or not subsequent exploration and development will occur in the area depend on several factors: 1) the subsurface geology of the area, 2) UCM's exploration strategy, and 3) the projected price of gas and its demand. Geology dictates the extent of exploration. Several dry holes (no substantial gas encountered) can discourage further exploration in an area. Whether a licensee proceeds with exploration of an area may depend on the area's priority when weighed against the licensee's other commitments. If extensive exploration does occur in an area, and an accumulation is discovered, conversion to lease and development and production will only proceed if the licensee/lessee can be assured an acceptable profit. This depends on the price of gas, the lessee's development costs, and the cost of getting the gas to market.

Where gas has been discovered, not more than one well per section (640 acres) may be drilled into the pool. A producer may apply to change the spacing requirements if there is technical justification to support greater ultimate recovery by changing the spacing requirements. A Conservation Order issued by the Oil and Gas Conservation Commission will grant exception to 20 AAC 25 upon finding and concluding the spacing exception will not cause waste.

Implementation of any gas exploration and development program, whether for conventional or unconventional gas, must meet the requirements of regulatory agencies prior to approval. Permit requirements will be evaluated in light of the particular activity proposed, and plans of operation must be approved with appropriate project-specific and site-specific safeguards. As new information becomes available, additional mitigation measures may be imposed on permits and any leases issued subsequent to the license.

E. Likely Methods of Gas Transportation

AS 38.05.035(g) directs that best interest findings shall consider and discuss the method or methods most likely to be used to transport gas from the area, and the advantages, disadvantages, and relative risks of each.

A discussion of specific transportation alternatives for gas from the license area is not possible at this time because strategies used to transport potential gas resources depend on many factors, most of which are unique to an individual discovery. The location and nature of gas deposits determine the type and extent of facilities necessary to develop and transport the resource. ADNR and other state,

federal, and local agencies will review the specific transportation system when it is actually proposed. Modern gas transportation systems usually include the following major components: 1) pipelines; 2) marine terminals; and 3) tank vessels.

Any natural gas ultimately produced from leases converted from UCM's exploration license will have to be transported to market or, if used to power UCM's mining operations, to UCM's facilities. It is important to note that the decision to license gas resources in the state does not authorize the transportation of any gas. If and when gas is found in commercial quantities and production is proposed, decisions on transportation will be made through the local, state, and federal permitting process. That process will consider any additional required environmental safeguards.

If the license is eventually converted to a lease, no gas will be transported from the lease area until the lessee has obtained the necessary permits and authorizations from federal, state, and local governments. The state has broad authority to withhold, restrict, and condition its approval of transportation facilities. In addition, the federal government has jurisdiction over various aspects of any transportation alternative.

The mode of transport from a discovery will be an important factor in determining whether future discoveries can be economically produced – the more expensive a given transportation option is, the larger a discovery will have to be in order to be economically viable.

1. Natural Gas Pipelines and Their Components

Gas pipelines are the most likely method for transporting gas from the Healy area. A pipeline gathering system consists of low pressure, low diameter pipes that carry raw natural gas from the wellhead to the processing plant (NGSA 2009). Because natural gas is more likely to be encountered in commercial quantities than oil, and the license is limited to gas only exploration, transportation of gas from the area would probably involve the construction of a pipeline transmission system. However at the licensing phase, the extent and location of gas transportation facilities are unknown.

There are various options for transporting natural gas to market. These include pipeline systems, liquefied natural gas (LNG), compressed natural gas (CNG), gas to solids (GTS), such as hydrates, gas to power, such as electricity, and gas to liquids (GTL) (Mokhatab et al. 2006).

A pipeline consists of all the components of a total system of pipe to transport natural gas for delivery, storage, or further transportation. It includes all pipe, pump or compressor stations, station equipment, tanks, valves, access roads, bridges, airfields, terminals and terminal facilities, operations control center, and all other facilities used or necessary for an integral line of pipe transportation (AS 38.35.230).

a. Pipe

The diameter of the pipe used in gas pipelines can vary greatly. Generally, small diameter pipe (0.5 to 6 inches in diameter) is used in gathering and distribution systems. Mainline pipes, the principle pipes in a given system, are between 16 and 48 inches in diameter. Most major interstate pipelines are between 24 and 36 inches in diameter. The actual pipeline itself consists of a strong carbon steel material, engineered to meet standards set by the American Petroleum Institute (NGSA 2009).

Pipe is produced in steel mills using two different production techniques. Small diameter pipe is produced seamlessly by heating a metal bar to very high temperatures and punching a hole through the middle of the bar to produce a hollow tube. Large diameter pipe is produced from sheets of metal folded into a tube and welded together to form a pipe section. All pipe is tested before shipment, to ensure it can meet the pressure and strength standards for transporting natural gas (NGSA 2009).

Pipe is also covered with a specialized coating to prevent corrosion and rust. This coating is usually a fusion bond epoxy, which gives the pipe a light blue color. In addition, cathodic protection is often

used, which runs electric current through the pipe to prevent and inhibit corrosion and rust (NGSA 2009).

b. Compressor Stations

Gas pipelines use compressors to push natural gas through the pipe after the gas has been treated. The distance the gas is being transported will determine the number of compressor stations required; they are usually placed at 40 to 100 mile intervals along a pipeline. The gas enters the compressor station, where it is compressed by a turbine, motor, or engine. Water may condense out of gas in transit and compressor stations also usually contain some type of liquid separator consisting of scrubbers and filters to capture any liquids or other undesirable particles, dehydrators to remove remaining water vapor, and heaters to prevent the formation of hydrates within the equipment (NGSA 2009).

c. Metering Stations

Metering stations are also located along gas pipelines. A metering station measures and monitors the flow of gas, using a computer system that coordinates the operation of valves and conditioning equipment. If a problem occurs, the computer initiates corrective actions and sounds alarms at the appropriate control points.

d. Valves

Valves are usually open and allow the gas to flow freely. They can also be used to stop the gas flow in a certain section of pipe. Valves can be placed every 5 to 20 miles along a pipeline, and are subject to regulation by safety codes.

e. Buried Pipelines

Buried pipelines are the preferred method for transporting gas. There are some important considerations regarding long sections of buried pipe. First is cost, which depends on length, topography, soils, and distance from the gravel mine site to the pipeline. Second, buried pipe is more difficult to monitor and maintain. However, significant technological advances in leak detection systems have been made which increase the ease with which buried pipelines can be monitored. Third, buried pipelines may result in increased loss of wetlands because of gravel fill. Finally, buried pipelines are sometimes not feasible from an engineering standpoint because of the thermal instability of fill and underlying substrate.

f. Additives

Natural gas utility companies like Enstar Natural Gas Company, which supplies natural gas to Southcentral Alaska, add an odorant such as mercaptan to gas destined for homes or business facilities. The human nose can detect a 1% concentration of this additive, far below dangerous levels. Natural gas mixed with this odorant provides a measure of safety by allowing leak detection by scent alone. Gas sent to petrochemical or LNG plants is not odorized since the chemical could interfere with processing.

g. Liquefied Natural Gas

There is also the potential for natural gas to be transported as a liquid natural gas (LNG). The likelihood of LNG mode transport will depend upon the location and the costs and benefits of a particular project. Natural gas that is cooled liquefies. It is stored in refrigerated tanks after processing. Specially built refrigerated tankers transport the LNG to storage locations or to market. The LNG must be processed to return it to the gas phase. Economies of scale are important to keep the cost per unit to commercially affordable rates (Mokhatab et al. 2006:20).

h. Natural Gas Storage

The availability of subsurface storage horizons and gas storage facilities affect the technologies and preferred routes of transportation used for natural gas distribution. Under AS 38.05.180(u) the Commissioner of ADNR may authorize subsurface storage of oil or gas to avoid waste or to promote conservation of natural resources. Subsurface storage may be utilized by natural gas developers if favorable geological and engineering properties of the storage reservoir are verified. Subsurface storage must comply with all applicable local, state, and federal statutes and regulations. Refer to Section C(4) above for more information relating to subsurface gas storage.

Facilities for gas storage may also serve as integral components of the natural gas transportation system. Cryogenic tanks are used to store liquefied natural gas (Mokhatab et al. 2006:20). Gas condensate is stored between production and shipping in condensate storage tanks (Mokhatab et al. 2006:256). Distances to market and the need to allocate supply at prescribed times of demand may justify the construction and operation of storage facilities along the distribution system route.

2. Regulating Pipelines

Jurisdictional authority over pipelines depends on many factors such as design, pipe diameter, product transported, whether it meets state or federal designation (e.g., transmission line, gathering line, or distribution line), and other attributes as specified in regulations. Generally, the design, maintenance, and preservation of transmission pipelines transporting gas are under the authority and jurisdiction of the Pipeline and Hazardous Materials Safety Administration (PHMSA) and specific regulations for natural gas (49 CFR 192). Both regulations prescribe the minimum requirements that all operators must follow to ensure the safety of their pipelines and piping systems. The regulations not only set requirements, but also provide guidance on preventive and mitigation measures, establish time frames for upgrades and repairs, and incorporate other relevant information such as standards incorporated by reference developed by various industry consensus organizations.

Both state and federal agencies have oversight of pipelines in Alaska. State agencies include the Petroleum Systems Integrity Office (PSIO) and DO&G within DNR; the State Pipeline Coordinator's Office; and ADEC. Federal agencies include the Pipeline and Hazardous Materials Safety Administration (PHMSA) within the U.S. Department of Transportation.

On December 29, 2006, the "Pipeline Inspection, Protection, Enforcement, and Safety Act of 2006" (Pipes Act H.R. 5782) was signed into law. The Pipes Act issued a final rule requiring hazardous liquid pipeline operators to develop integrity management programs for transmission pipelines. Basic requirements for an integrity management plan include:

- Periodic integrity assessment of pipelines that could affect high consequence areas (HCAs). Integrity assessments are performed by in-line inspection (also referred to as "smart pigging"), hydrostatic pressure testing, or direct assessment. Through these assessment methods, potentially injurious pipeline defects that could eventually weaken the pipe, or even cause it to fail, are identified early and can be repaired, thus improving the pipe's integrity.
- Development and implementation of a set of safety management and analytical processes, collectively referred to as an integrity management program (IMP). The purpose of the program is to assure pipeline operators have systematic, rigorous, and documented processes in place to protect HCAs (PHMSA 2008).

Integrity management programs reflect significant improvements to pipeline safety and have unique aspects depending on service characteristics for natural gas and liquid hydrocarbons. The Gas Transmission IM Rule (49 CFR 192, Subpart O), the "Gas IM Rule," as it is commonly referred to, became effective in February 2004, and represents a significant enhancement to PHMSA's existing

gas pipeline safety regulations. The Gas IM Rule specifies how pipeline operators must identify, prioritize, assess, evaluate, repair, and validate - through comprehensive analyses - the integrity of gas transmission pipelines that, in the event of a leak or failure, could affect HCAs within the United States. These HCAs include certain populated and occupied areas. The framework for an integrity management system are covered in Subpart O - Gas Transmission Pipeline Integrity Management (49 CFR 192.907) and integrity program elements are in 49 CFR 192.911, which invoke ASME/ANSI B31.8S by reference.

F. Hazardous Spills and Release of Gas

1. Spills

The exploration license is a gas only exploration license because there is little likelihood of any oil reserves in the license area. Consequently, there is little likelihood of an oil spill. ADEC administers and enforces laws and regulations related to oil spill prevention and cleanup contingency plans. To ensure that a contingency plan is not required for a well, ADEC requires AOGCC to make a determination that the exploration wells will not penetrate a formation capable of flowing oil to the ground surface (AS 46.04.050; AS 31.05.030(l)). If that determination cannot be made, the licensee is required to have an approved oil discharge prevention and contingency plan (C-Plan) and determination of financial responsibility prior to commencing operations.

Although crude oil will not be handled, other hazardous substances probably will be. Whenever hazardous substances are handled, there is a risk of a spill. Consequently, measures are imposed to reduce, minimize, or mitigate spills. For example, secondary containment is required for storage or transfers of fuel or hazardous substances, and containers with a storage capacity of 55 gallons or greater may not be stored within 500 ft of a waterbody.

2. Well Blowout

A well blowout can take place when high pressure gas is encountered in the well and sufficient precautions, such as increasing the weight of the drilling mud, are not effective. The result is that gas or mud is suddenly and violently expelled from the well bore, followed by uncontrolled flow from the well. Blowout preventers, which immediately close off the open well to prevent or minimize any discharges, are required for all drilling and work-over rigs and are routinely inspected by AOGCC (AS 46.04.030). Blowout preventers greatly reduce the risk of a gas release. If a release occurred, however, the released gas would simply dissipate unless it is ignited by a spark. Ignition could result in a violent explosion (MMS 1998).

Each well has a blowout prevention program that is developed before the well is drilled. Operators review bottom-hole pressure data from existing wells in the area and seismic data to learn what pressures might be expected in the well to be drilled. Engineers use this information to design a drilling mud program with sufficient hydrostatic head to overbalance the formation pressures from surface to the total depth of the well. They also design the casing strings to prevent various formation conditions from affecting well control performance. Blowout prevention (BOP) equipment is installed on the wellhead after the surface casing is set and before actual drilling begins. BOP stacks are routinely tested in accordance with government requirements (BPX 1996).

Wells are drilled according to the detailed plan. Drilling mud and well pressures are continuously monitored, and the mud is adjusted to meet the actual wellbore pressures. The weight of the mud is the primary well control system. If a kick (sudden increase in well pressure) occurs, the well is shut-in using the BOP equipment. The BOP closes off and contains fluids and pressures in the annulus and in the drill pipe. Technicians take pressure readings and adjust the weight of the drilling mud to compensate for the increased pressure. BOP drills are performed routinely with all crews to ensure

wells are shut-in quickly and properly. Rig foremen, tool pushers, drillers, derrick men and mud men all have certified training in well control that is renewed annually (BPX 1996).

Blowouts are extremely rare in Alaska and their numbers decline as technology, experience, and regulation impact drilling practices (ADN 2008). A blowout that results in an oil spill has never occurred in Alaska. Natural gas blowouts have occurred. About 5,570 oil and gas wells have been drilled on the North Slope and it's been over 13 years since the last gas blowout (ADN 2008). A gas blowout occurred at the Cirque No. 1 well in 1992. The accident occurred while ARCO workers were drilling an exploratory well and hit a shallow zone of natural gas. Drilling mud spewed from the well and natural gas escaped. It took 2 weeks to plug the well (Anchorage Times 1992). In 1994, a gas kick occurred at the Endicott field I-53 well. BP Exploration was forced to evacuate personnel and shut down most wells on the main production island. No oil was released to the surface, as the well had not yet reached an oil-bearing zone. There were no injuries, and the well was killed 3 days later by pumping heavily weighted drilling muds into it (Schmidt 1994; ADN 1994).

3. Pipeline Release

Effective monitoring of gas pipelines is crucial and the technology for monitoring is continually improving. To ensure the efficient and safe operation of pipelines, operators are required to routinely inspect pipelines for corrosion and defects. This is done through the use of robotic devices known as "pigs" which are propelled down pipelines to evaluate the interior of the pipe. Pigs can test pipe thickness, roundness, check for signs of corrosion, detect minute leaks, and any other defect along the interior of the pipeline that may either impede the flow of gas, or pose a potential safety risk for the operation of the pipeline (NGSA 2009). Pigs can be sent through the pipeline on a regular schedule to detect changes over time and give advance warning of any potential problems. The Trans-Alaska Pipeline System operation has pioneered this effort for Arctic pipelines. The technique is now available for use worldwide and represents a major tool for use in preventing pipeline failures.

To monitor pipelines, the industry relies on data provided by Supervisory Control and Data Acquisition (SCADA) systems, computerized systems that take measurements and collect data along the pipeline and transmit them to the control station. SCADA is a real-time system, allowing operators to monitor the pipeline and remotely adjust equipment. (NGSA 2009)

If pipelines are used in the development of the license area, operators would follow the appropriate American Petroleum Institute recommended practices. They would inspect the pipelines regularly to determine if any damage was occurring and would perform regular maintenance. Preventive maintenance includes installing improved cathodic protection, using corrosion inhibitors, and continuing regular visual inspections.

In addition to inspection with pigs, there are a number of precautions and procedures routinely used to prevent or minimize the risk of accidents, including aerial patrols, leak detection, pipeline markers, gas sampling, preventive maintenance, vapor sensing, and pipeline inspection (NGSA 2009).

Aerial Patrols: Airplanes can be used to inspect flowlines and pipelines thereby reducing the possibility of a natural or man-made event that would threaten the integrity of the line.

Leak Detection: Natural gas detecting equipment is periodically used by personnel on the surface to check for leaks. This is especially important if the gas has not been odorized. A number of leak detection systems are already in use or proposed for Alaska gas pipeline development. Leak detection systems and effective emergency shut-down equipment and procedures are essential. Once a leak is detected, valves at both ends of the pipeline, as well as intermediate block valves, can be manually or remotely closed to limit the amount of discharge. Both internal (inferential) and external (direct) leak detection systems exist for pipelines. Computational pipeline monitoring is the main

category of internal leak detection systems, in which a computer analyzes data collected from field instruments and alerts the pipeline controller to anomalies. The pipeline controller then investigates the anomalies and initiates a response if a product is released. The three main categories of computational pipeline monitoring are volume balance, pressure analysis, and real time transient modeling systems.

Advances in technology contribute new methods to prevent and detect leaks. One example is duoThane®[1]. Developed with support from EPA, the sensors use active gas corelation radiometry, using an active infrared source and an optical, spectral correlation to detect a leak. duoThane®[1] reduces the costs associated with pipeline inspections, provides superior leak detection, and results in fewer false alarms (EPA 2004). Many other leak detection systems are available to industry, with advantages and disadvantages for each technique. No single technique has yet become the industry standard (Sivathanu 2009).

Pipeline Markers: Signs on the surface above natural gas pipelines indicate the presence of underground pipelines to the public, to reduce the chance of any interference with the pipeline.

Gas Sampling: Routine sampling of the gas in the pipeline ensures its quality, and may also indicate corrosion of the interior of the pipeline, or the influx of contaminants.

Preventive Maintenance: Valves are tested, and surface impediments are removed to allow pipeline inspection.

Vapor Sensing: Vapor sensing detection systems are more frequently used for storage tanks, but can be applied to pipelines. Probes are installed in the soil and a vacuum applied, then soil gas samples are collected for analysis. As product enters the soil, vapors migrate to the surrounding soil pore spaces. Tracers or chemical markers may be applied to the product to facilitate differentiation from background vapors. When the tracer or marker is identified in a soil gas sample, a leak has occurred. Vapor sensing leak detection systems require a conduit to be installed along the length of the pipeline. This may be either a small perforated tube next to the pipeline, or it may completely encompass the pipeline.

Pipeline Inspection: ADEC regulations governing pipelines require all buried pipelines be protected from corrosion by protective wrapping or coating and cathodic protection, and all seams must be welded (no claps or threaded seems are allowed). The ADEC approved corrosion control program must be followed; above-ground pipe must be inspected at least monthly and support members designed to be stable and composed of materials to minimize corrosion and prevent chafing.

No gas may be transported until the operator has obtained the necessary permits and authorizations from federal, state, and local governments. ADNR and other state, federal, and local agencies will review the specific gas transportation system if and when it is proposed.

Measures are designed to avoid, minimize, and mitigate any potential releases from a pipeline. Pipelines must be buried where conditions allow and must be designed and constructed to assure integrity against climate and geophysical hazards. The plan of operations must include an emergency plan that is specifically designed to address pipeline leaks or ruptures.

4. Alaska Risk Assessment of Oil and Gas Infrastructure

In May 2007, the Alaska Risk Assessment (ARA) project was launched. The purpose of the 3-year, $5 million initiative is to evaluate Alaska's oil and gas infrastructure for its ability to operate safely

[1] Use of product names does not constitute product endorsement.

for another generation. It is expected that oil and gas infrastructure on the North Slope and Cook Inlet, and the Trans-Alaska Pipeline, will be included (ADEC 2008).

The ARA will provide status of existing infrastructure, components, systems, and hazards. The likelihood and consequences of possible failures in Alaska's oil and gas infrastructure will be examined, and potential failures that could affect the reliability of the system or its ability to sustain production without unplanned interruptions, will be identified and prioritized. Rankings will be based on consequences to state revenue, safety, and the environment. Mitigation measures will be recommended based on identified risks (ADEC 2008).

G. References

ADEC (Alaska Department of Environmental Conservation)
2008 Alaska risk assessment (ARA) of oil and gas infrastructure. Division of Spill Prevention and Response. http://www.dec.state.ak.us/spar/ipp/ara/index.htm Accessed September 9, 2008.

ADN (Anchorage Daily News)
1994 BP stops Endicott field gas leak: Shot of drilling mud plugs well; production to resume after inspection. Anchorage, AK.

ADN (Anchorage Daily News)
2008 Recent blowout is one of only 18 in Alaska. Anchorage Daily News. December 18, 2008. http://www.adn.com/money/story/627963.html Accessed February 2, 2009.

Anchorage Times
1992 Gas blowout strikes ARCO well.

Bailey, A.
2005 Looking for North Slope coalbed methane. Petroleum News. http://www.petroleumnews.com/pnads/10046078 Accessed 4/21/09.

Bailey, A.
2008 Going for Liberty. Petroleum News. July 20, 2008. http://www.petroleumnews.com/pnads/766668174.shtml Accessed January 23, 2009.

Bailey, A.
2009 New alliance for low-impact drilling. Petroleum News. http://www.petroleumnes.com/pnads/160486741.shtml Accessed 4/21/2009.

Balay, J.
2003 Summit addresses coalbed methane concerns. DCC News. Denali Citizens Council. http://www.denalicitizens.org/cbm_summit.pdf Accessed

BPX (British Petroleum Exploration, Alaska, Inc.)
1996 Northstar Project, BP Exploration (Alaska) proposal for modified lease terms.

CBM
2004 CBM primer. Energy Processing Canada. http://findarticles.com/p/articles/mi_qa5406/is_200409/ai_n21362602/?tag=content;col1 Accessed

Centre for Energy
2008 Air: flaring and venting. http://www.centreforenergy.com/generator.asp?xml=/silos/ong/UNGEnv02XML.asp&template=1,2,0 Accessed December 11, 2008.

Clark, A. and B. Fisk
2008 Results from the coalbed methane exploration and testing project Wainwright, Alaska 2007-2008. US DOI, Alaska Rural Energy Project http://www.alaska.edu/uaf/cem/ine/aetdl/conferences/2008Presentations/CoalBedMethan.A.Clark.pdf

Csejtey, B. J., M. W. Mullen, D. P. Cox and G. D. Stricker
1992 Geology and geochronology of the Healy Quadrangle, south-central Alaska. U.S. Geological Survey Miscellaneous Investigations 1961. http://www.dggs.dnr.state.ak.us/webpubs/usgs/i/text/i-1961.PDF

EPA (Environmental Protection Agency)
2004 AGCS sensor for gas leak detection. http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/5189/report/F

Gerding, M.
1986 Fundamentals of petroleum, *third edition*. University of Texas, Petroleum Extension Service, Austin, TX.

Miller, D. J., T. G. Payne and G. Gryc
1959 Geology of possible petroleum provinces in Alaska. U.S. Geological Survey. Survey bulleting 1094, Washington, U.S. Government printing office.

MMS (Minerals Management Service)
1998 Evaluation of cleanup capabilities for large blowout spills in the Alaskan Beaufort Sea during periods of broken ice. Prepared by: S.L. Ross Environmental Research Ltd., D.F. Dickins and Associates, and Vaudrey and Associates for Alaska Clean Seas and Minerals Management Service on behalf of North Slope Spill Response Project Team. http://www.mms.gov/tarprojects/297/297AA.PDF

Mokhatab, S., W. A. Poe and J. G. Speight
2006 Handbook of natural gas transmission and processing. Gulf Professional Publishing, an imprint of Elsevier, Burlington, MA.

NGSA (Natural Gas Supply Association)
2004 Naturalgas.org. http://naturalgas.org/ Accessed

NGSA (Natural Gas Supply Association)
2009 Natural gas supply association. http://naturalgas.org Accessed 4/15/09.

Pewe, T. L., C. Wahrhaftig and F. Weber
1966 Geologic map of the Fairbanks quadrangle. U.S. Geologic Survey

PHMSA (Pipeline and Hazardous Materials Safety Administration)
2008 Pipeline and Hazardous Materials Safety Administration. U.S. Department of Transportation. http://phmsa.dot.gov/pipeline/about Accessed August 28, 2008.

Schmidt, R. G. (Unocal)
1994 Personal communication from G. Russell Schmidt, Unocal to Tom Bucceri, DO&G. April 22, 1994.

Sivathanu, Y.
2009 Technology status report on natural gas leak detection in pipelines. U.S. Department of Energy, National Energy Technology Laboratory, http://www.netl.doe.gov/technologies/oil-gas/publications/Status_Assessments/scanner_technology_0104.pdf

Stanley, R. G.
1995 National oil and gas assessment; central Alaska province. 1995 geologic report. USGS Central Energy Team.

Troutman, S. M. and R. G. Stanley
2002 Map and digital database of sedimentary basins and indications of petroleum in the central Alaska province. U.S. Geological Survey open-file report 02-483. http://geopubs.wr.usgs.gov/open-file/of02-483/

USGS (U.S. Geological Survey)
2007 Divisions of geologic time - major chronostratigraphic and geochronologic units. USGS Geological Survey Geologic Names Committee. USGS Fact Sheet 2007-3015. http://pubs.usgs.gov/fs/2007/3015/fs2007-3015.pdf

Chapter Seven: Governmental Powers to Regulate Natural Gas

Table of Contents

Table of Contents (continued)

Chapter Seven: Governmental Powers to Regulate Natural Gas

All exploration license and subsequent lease activities (exploration, development, production, and transportation) are subject to numerous federal, state, and local statutes, regulations, policies, and ordinances, with which the licensee is obligated to comply. This chapter does not provide a comprehensive description of the multitude of laws and regulations that may be applicable to such activities, but it does illustrate the broad powers of the various government agencies to prohibit, regulate, and condition activities related to oil and gas. Each of the regulatory agencies (state, federal, and local) has a different role in the oversight and regulation of oil and gas activities, although some agencies may have overlapping authorities. Important laws and regulations applicable to oil and gas activities are included in Appendix B. A draft exploration license is contained in Appendix C, and a draft conversion lease contract is contained in Appendix D.

An exploration license grants the licensee exclusive rights to subsurface mineral interests. However, an exploration license does not authorize any subsequent activities. The licensee's rights to drill for, extract, remove, clean, process, and dispose of any gas that may underlie the lands described by the exploration license are subject to the terms of the license, approved plans of operation, subsequent leases, and all applicable local, state, and federal laws and regulations.

Easy agency requires various permits, approvals, and review processes, some of which are discussed below. However, there is no “typical” project. Actual processes and terms and conditions will vary with time-certain, site-specific operations. Each agency, therefore, has field monitors assigned to ensure that operations are conducted as approved. The appropriate statutes and regulations should be consulted when specifics are required.

A. Alaska Department of Natural Resources

ADNR, through the Division of Oil and Gas, Division of Mining, Land and Water, and the State Historic Preservation Office, reviews, coordinates, conditions, and approves plans of operations or development and other permits as required before on-site activities can take place. Each plan of operations is site-specific and must be tailored to the activity requiring the permit. A plan of operations is required to identify the specific measures, design criteria, and construction methods and standards to be employed so as to comply with the terms of the license or lease. Applications for other state or federal agency authorizations or permits must be submitted with the plan of operations. The department monitors activities through field inspection once they have begun. The area under consideration for an exploration license is not in the coastal zone and is therefore not subject to the Alaska Coastal Management Program review process.

1. Plan of Operations Approval

Land use activities within the exploration license area and subsequent gas leases are regulated under 11 AAC 83.158 and paragraph 9 of the draft exploration license (Appendix C). These require the licensee to prepare plans of operations that must be approved by DO&G before the licensee may commence any activities. Except for uses and activities appearing on the list in 11 AAC 96.020, the licensee must prepare a plan of operations and obtain all required approvals and permits for each phase of exploration, development, or production before implementation of that activity. Permit applications and plans are generally available for public review and public notice is usually given for development plans of operations.

An application for approval of a plan of operations must contain sufficient information, based on data reasonably available at the time the plan is submitted for approval, for the commissioner to determine the surface use requirements and impacts directly associated with the proposed operations. An application must include statements and maps or drawings setting out the following:

(1) the sequence and schedule of the operations to be conducted on or in the license area, including the date operations are proposed to begin and their proposed duration;

(2) projected use requirements directly associated with the proposed operations, including the location and design of well sites, material sites, water supplies, solid waste sites, buildings, roads, utilities, airstrips, and all other facilities and equipment necessary to conduct the proposed operations;

(3) plans for rehabilitation of the affected licensed area after completion of operations or phases of those operations; and

(4) a description of operating procedures designed to prevent or minimize adverse effects on other natural resources and other uses of the licensed or leased area and adjacent areas, including fish and wildlife habitats, historic and archeological sites, and public use areas (11 AAC 83.158(d)).

When it considers a plan of operations, ADNR often requires stipulations, in addition to the mitigation measures developed through the best interest finding. These additional stipulations address site-specific concerns directly associated with the proposed project. The license stipulations and the terms and conditions of the license are attached to the plan of operations approval and are binding on the licensee. The exploration license also requires that the licensee keep the area open for inspection by authorized state officials. Activities are monitored in the field by ADNR, ADEC, ADF&G, and AOGCC to ensure compliance with each agency's respective permit terms. In addition, each permittee must post a bond before beginning operations (11 AAC 83.160). Each permittee must post a $500,000 statewide bond to cover a drill site. Approvals for license and lease operations are generally granted for three years.

2. Geophysical Exploration Permit

The geophysical exploration permit is a specific type of land use permit issued by DO&G under 11 AAC 96.010. Seismic surveys are the most common activity authorized by this permit. The purpose of the permit is to minimize adverse effects on the land and its resources while making important geological information available to the state (11 AAC 96.210). Under AS 38.05.035(a)(8)(C), the geological and geophysical data that are made available to the state are held confidential at the request of the licensee. If the seismic survey is part of an exploration well program, the permit will be reviewed as part of the exploration well permit package.

The application must contain the following information in sufficient detail to allow evaluation of the planned activities' effects on the land:

(1) a map at a sufficient scale showing the general location of all activities and routes of travel of all equipment for which a permit is required;

(2) a description of the proposed activity, any associated structures, and the type of equipment that will be used (11 AAC 96.030(a)).

Maps showing the precise location of the survey lines must also be provided, though this information is usually held confidential. A $100,000 bond is required to conduct seismic work. The bond amount for other geophysical surveys is determined when the activity is proposed.

A geophysical exploration permit contains measures to protect the land and resources of the area. The permit is usually issued for a single survey season, but may be extended. If the permit is

extended, the director may modify existing terms or add new ones. The permit is revocable for cause for violation of a permit provision or of 11 AAC 96, and is revocable at will if the department determines that revocation is in the state's interest. A permit remains in effect for the term issued, unless revoked sooner. The department will give 30 days' notice before revoking a permit at will. A revocation for cause is effective immediately (11 AAC 96.040(a)).

3. Pipeline Rights-of-Way

Most transportation facilities within the license area or beyond the boundaries of the license area must be authorized by ADNR under the Right-of-Way Leasing Act (AS 38.35). This act gives the commissioner broad authority to oversee and regulate the transportation of oil and gas by pipelines that are located in whole or in part on state land, to ensure the state's interests are protected. The Right-of-Way Leasing Act process is administered by the State Pipeline Coordinator's Office.

4. Temporary Water Use Authorization

Exploration activities may require a temporary water use authorization issued by DMLW. A temporary water use authorization is required under 11 AAC 93.035 before the temporary use of a significant amount of water, if the use continues for less than five consecutive years and the water applied for is not otherwise appropriated. The authorization may be extended one time for good cause for a period of time not to exceed five years. An application must include: (1) the application fee; (2) a map indicating the section, township, range, and meridian, and indicating the location, of the property, the point of withdrawal, diversion, or impoundment, and the point of use; (3) the quantity of water to be used; (4) the nature of the water use; (5) the time period during which the water is to be used; and (6) the type and size of equipment used to withdraw the water. DMLW may issue an authorization for the temporary use of water subject to conditions, including suspension or termination, considered necessary to protect the water rights of other persons or the public interest. Information on lake bathymetry, fish presence, and fish species may be required when winter water withdrawal is proposed to calculate the appropriate withdrawal limits.

5. Permit and Certificate to Appropriate Water

Industrial or commercial use of water requires a Permit to Appropriate Water under 11 AAC 93.120. The permit is issued for a period of time consistent with the public interest and adequate to finish construction and establish full use of water. The maximum time period for which a permit will be issued for industrial or commercial use is five years, unless the applicant proves or the commissioner independently determines that a longer period is required. The commissioner may issue a permit subject to terms, conditions, restrictions, and limitations necessary to protect the rights of others, and the public interest. Under 11 AAC 93.120(e), permits require: that no certificate be issued until evidence is presented of adequate easements or other means necessary to complete the appropriation; that the permittee measure the water use and report water use information to ADNR; and that the permittee maintain, or restrict from withdrawing, a specific quantity, rate of flow or volume of water to protect fish and wildlife habitat, recreation purposes, navigation, sanitation or water quality, prior appropriators, or any other purpose the department determines is in the public interest.

A Certificate of Appropriation will be issued under 11 AAC 93.130 if the permit holder: (1) submits a statement of beneficial use stating that the means necessary for the taking of water have been developed and the permit holder is beneficially using the quantity of water to be certified, along with the required fee; and (2) has substantially complied with all permit conditions. Again, the commissioner may issue a certificate subject to conditions necessary to protect the public interest. For example, conditions must be developed to maintain a specific quantity of water at a given point on a stream or water body, or in a specified stretch of stream, throughout the year or for specified times of the year, to protect fish and wildlife habitat, recreation, navigation, sanitation and water

quality, and prior appropriators, or any other purpose the commissioner determines is in the public interest (11 AAC 93.130(c)(1)).

6. Land Use Permits

Land use permits are issued by DMLW and may be required for exploration, development, and production activities. Land use permits can be issued for periods up to five years depending on the activity, but ADNR anticipates permits issued in conjunction with the exploration license will likely be for a period of one year.

In accordance with 11 AAC 96.025, a generally allowed use listed in 11 AAC 96.020 is subject to the following conditions:

(1) activities employing wheeled or tracked vehicles must be conducted in a manner that minimizes surface damage;

(2) vehicles must use existing roads and trails whenever possible;

(3) activities must be conducted in a manner that minimizes

(A) disturbance of vegetation, soil stability, or drainage systems;

(B) changing the character of, polluting, or introducing silt and sediment into streams, lakes, ponds, water holes, seeps, and marshes; and

(C) disturbance of fish and wildlife resources;

(4) cuts, fills, and other activities causing a disturbance listed in (3)(A) - (C) of this section must be repaired immediately, and corrective action must be undertaken as may be required by the department;

(5) trails and campsites must be kept clean; garbage and foreign debris must be removed; combustibles may be burned on site unless the department has closed the area to fires during the fire season;

(6) survey monuments, witness corners, reference monuments, mining location posts, homestead entry corner posts, and bearing trees must be protected against destruction, obliteration, and damage; any damaged or obliterated markers must be reestablished as required by the department under AS 34.65.020 and AS 34.65.040;

(7) every reasonable effort must be made to prevent, control, and suppress any fire in the operating area; uncontrolled fires must be immediately reported;

(8) holes, pits, and excavations must be repaired as soon as possible; holes, pits, and excavations necessary to verify discovery on prospecting sites, mining claims, or mining leasehold locations may be left open but must be maintained in a manner that protects public safety;

(9) on lands subject to a mineral or land estate property interest, entry by a person other than the holder of a property interest, or the holder's authorized representative, must be made in a manner that prevents unnecessary or unreasonable interference with the rights of the holder of the property interest.

7. Material Sale Contract

If the operator proposes to use state-owned gravel or other materials for construction of pads and roads, a DMLW material sale contract is required. The contract must include a description of the sale area, the volume of material to be removed from the sale area, the method of payment by the purchaser, the method of removal of the material, the bonds and deposits required of the purchaser,

the method of scaling to be used by the purchaser, the purchaser's liability under the contract, the improvements to and occupancy of the sale area required of the purchaser, and the reservation of material within the sale area to DMLW. A material sale contract must also include the purchaser's site-specific operating requirements, including requirements relating to boundary markers and survey monument protection; erosion control and protection of water; fire prevention and control; roads; sale area supervision; protection of fish, wildlife, and recreational values; sale area access; and public safety. A contract must state the date upon which the severance or extraction of material under the contract is to be completed. A contract may be extended before its expiration if the director determines that the delay in completing the contract is due to unforeseen events beyond the purchaser's control, or the extension is in the best interests of the state.

In connection with a material sale, the DMLW director may require the purchaser to provide a performance bond that guarantees performance of the terms of the contract. If the director requires a performance bond, the bond amount will be based on the total value of the sale. The performance bond must remain in effect for the duration of the contract unless released in writing by the director.

8. Office of History and Archaeology

The Alaska Heritage Resources Survey (AHRS) is an inventory of all reported historic and prehistoric sites within the state and is maintained by ADNR's Office of History and Archaeology. This inventory of cultural resources includes objects, structures, buildings, sites, districts, and travel ways, with a general provision that they are over 50 years old. Over 22,000 sites have been reported within Alaska (however, this is probably only a small percentage of the sites that may actually exist but are as yet unreported). The fundamental use of the AHRS is to protect cultural resource sites from unwanted destruction. Before beginning a project, information regarding important cultural and historic sites can be obtained by contacting the Office of History and Archaeology.

AS 41.35.010, the Alaska Historic Preservation Act says that "It is the policy of the state to preserve and protect the historic, prehistoric, and archaeological resources of Alaska from loss, desecration, and destruction so that the scientific, historic, and cultural heritage embodied in those resources may pass undiminished to future generations." Existing statutes, which apply to both known sites and newly discovered sites, include:

- **AS 41.35.200**. Unlawful acts. A person may not appropriate, excavate, remove, injure, or destroy, without a permit from the commissioner, any historic, prehistoric, or archaeological resources of the state. "Historic, prehistoric, or archaeological resources" includes deposits, structures, ruins, sites, buildings, graves, artifacts, fossils, or other objects of antiquity which provide information pertaining to the historical or prehistorical culture of people in the state as well as to the natural history of the state (AS 41.35.230(2)).
- **AS 41.35.210**. Criminal penalties. A person who is convicted of violating a provision of AS 41-35.010 – 41.35.240 is guilty of a class A misdemeanor.
- **AS 41.35.215**. Civil penalties. In addition to other penalties and remedies provided by law, a person who violates a provision of AS 41.35.010 – 41.35.240 is subject to a maximum civil penalty of $100,000 for each violation.

9. Petroleum Systems Integrity Office

The Petroleum Systems Integrity Office (PSIO) is the lead state agency in exercising oversight of the maintenance of facilities, equipment, and infrastructure for the sustained production and transportation of oil and natural gas resources in Alaska, including such facilities, equipment, and infrastructure not currently within the jurisdiction of another state or federal agency. Through designated agency liaisons, PSIO leads interagency efforts to evaluate industry oversight. Designated

agencies, to the extent authorized through legal authorities, require oil and gas producers and operators to provide a comprehensive description of current practices that includes the quality control, quality assurance, monitoring, inspection, and other practices used to ensure the integrity and reliability of oil and natural gas facilities, equipment, infrastructure and activities. The PSIO makes recommendations to the commissioner of ADNR regarding ADNR enforcement actions and cases to be referred to other state, local, or federal agencies for appropriate civil or criminal penalties available under the law.

10. Review Process

Most ADNR permit actions require a 30-day review; surface occupancy issues or other related local permits may require additional time. Plans of operation applications submitted to ADNR require public notice and a public comment period. Additionally, a review is conducted with ADFG and ADEC, as well as any affected coastal districts.

B. Alaska Department of Environmental Conservation

ADEC has statutory responsibility for controlling air, land, and water pollution, and oil spill prevention and response. ADEC implements and coordinates several federal regulatory programs in addition to state laws. AOGCC also has regulatory authority over these actions if the activity involves a class II injection well. Several separate written permits are required before activity can begin. For instance, before solid waste disposal, wastewater, or air quality permits are issued, two public notices and an opportunity for public comment (and a public hearing, if requested) are required.

1. Air Quality Permits

ADEC administers an air quality program under a federally-approved State Implementation Plan. Through this plan, federal requirements of the Clean Air Act are met including National Ambient Air Quality Standards, New Source Review (NSR), New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants, and Prevention of Significant Deterioration. ADEC also monitors air quality and compliance.

The National Ambient Air Quality Standards set limits on pollutants considered harmful to public health and the environment (EPA 2008b). Limits have been defined for principal pollutants, or criteria pollutants: carbon monoxide, lead, nitrogen dioxide, particulate matter (PM_{10}), particulate matter ($PM_{2.5}$), ozone, and sulfur dioxide. NSR, a permitting program required for new construction projects, ensures that air quality is not degraded by the new project, and that large new or modified industrial sources will be as clean as possible (EPA 2008e). New Source Performance Standards are intended to promote use of the best air pollution control technologies available, and they take into account the cost of the technology and any other non-air quality, health, and environmental impact and energy requirements (EPA 2008d). The National Emissions Standards for Hazardous Air Pollutants are set for air pollutants that are not covered by National Ambient Air Quality Standards, but that may be harmful (EPA 2008c). The standards are categorized by type of source, and require the maximum degree of reduction in emissions that is achievable, as determined by the EPA. The purpose of the Prevention of Significant Deterioration program is:

> …to protect public health and welfare; preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historic value; insure that economic growth will occur in a manner consistent with the preservation of existing clean air resources; and assure that any decision to permit increased air pollution…is made only after careful evaluation of all the

> consequences of such a decision and after adequate procedural opportunities for informed public participation in the decision making process. (EPA 2008e.)

The two primary types of permits issued to meet these requirements are Title I Construction Permits and Title V Operation Permits (EPA 2008a). Permits are legal documents that the applicant must follow. Permits specify what activities are allowed, what emission limits must be met, and may specify how the facility must be operated. Permits may contain monitoring, recordkeeping, and reporting requirements to ensure that the applicant meets the permit requirements (EPA 2008e).

a. Title I (NSR) Construction Permits

i. Permit Description

Title I permits incorporate air quality requirements for the Prevention of Significant Deterioration as well as other requirements of the Clean Air Act. This permit must be obtained before onsite construction can begin. Title I permits are required for projects that are new major sources for pollutants, or major modifications at existing sources. Prevention of Significant Deterioration requires installation of the "Best Available Control Technology (BACT)"; an air quality analysis; an additional impacts analysis; and public involvement (EPA 2008e).

BACT is determined on a case-by-case basis and takes into account energy, environmental, and economic impacts. BACT includes add-on control equipment, or modifications to production processes or methods. Examples include fuel cleaning or treatment, innovative fuel combustion techniques; and design, equipment, work practice, or operational standards (EPA 2008e).

An air quality analysis is required to show that new emissions will not violate air quality standards. In general, an assessment of existing air quality and predictions of future air quality that will result from the project are required (EPA 2008e).

ii. Review Process

The permitting process includes a pre-application meeting between the applicant and ADEC, several ADEC reviews and a Technical Analysis Report, and a 30-day public comment period, after which ADEC may issue a final permit. The final permit includes a final Technical Analysis Report and response to comments. The process for a Title I process can take up to three years, depending on the amount of meteorological data collection required. The permit must be obtained before construction may begin.

b. Title V Operation Permits

i. Permit Description

The federal Clean Air Act of 1970, and its subsequent 1990 revision and expansions (42 USC §§ 7401-7661), give EPA the authority to limit emissions from point sources (EPA 2007). EPA regulations require facilities that emit certain pollutants or hazardous substances to obtain a permit to operate the facility, known as a Title V permit. In Alaska, ADEC is responsible for issuing Title V permits and making compliance inspections (ADEC 2008a; 18 AAC 50, and AS 46.14). Permits are legally binding and include enforceable conditions with which the operator must comply. The permit establishes limits on the type and amount of emissions allowed, requirements for pollution control devices and prevention activities, and monitoring and record keeping requirements (EPA 2008f).

ii. Review Process

Operators have 12 months to submit their completed Title V permit after commencing their operations, which can continue while ADEC processes the application. However, significant revisions to an existing permitted facility cannot be made until the permit revision is approved by

ADEC. Processing time for permit revisions can be up to 6 months. Title V permits and revisions can be processed concurrently with Title I permits.

2. Solid Waste Disposal Permit

ADEC regulates solid waste storage, treatment, transportation, and disposal under 18 AAC 60. EPA regulates RCRA hazardous wastes and UIC Class I injection wells, and the AOGCC regulates UIC Class II oil and gas wells.

For all solid waste disposal facilities regulated by ADEC, a comprehensive disposal plan is required, which must include engineering design criteria and drawings, specifications, calculations, and a discussion demonstrating how the various design features (liners, berms, dikes) will ensure compliance with regulations. Before approval, solid waste disposal permit applications are reviewed for compliance with air and water quality standards, wastewater disposal, and drinking water standards, as well as for their consistency with the Alaska Historic Preservation Act. The application for a waste disposal permit must include a map or aerial photograph (indicating relevant topographical, geological, hydrological, biological, and archaeological features) with a cover letter describing the type, estimated quantity, and source of the waste, as well as the type of facility proposed. Roads, drinking water systems, and airports within a two-mile radius of the site must be identified, along with all residential drinking water wells within one-half mile. There must also be a site plan with cross-sectional drawings that indicate the location of existing and proposed containment structures, material storage areas, monitoring devices, area improvements, and on-site equipment. An evaluation of the potential for generating leachate must be presented as well. For above-grade disposal options, baseline water-quality data may be needed to establish the physical and chemical characteristics of the site before installing a containment cell.

Non-drilling-related solid waste must be disposed of in an ADEC permitted solid waste landfill. All other solid waste (except for hazardous materials) must be disposed of in an approved monofill (18 AAC 60.400-.495). A monofill is a landfill or drilling waste disposal facility that receives primarily one type of solid waste and that is not an inactive reserve pit (18 AAC 60.990(80)). An inactive reserve pit is a drilling waste disposal area, containment structure, or group of containment structures where drilling waste has not been disposed of after January 26, 1996, and at which the owner or operator does not plan to continue disposing of drilling waste (18 AAC 60.990(62)). Closure of inactive reserve pits is regulated under 18 AAC 60.440.

Drilling waste disposal is specifically regulated under 18 AAC 60.430. Design and monitoring requirements for drilling waste disposal facilities are identified in 18 AAC 60.430(c) and (d), respectively. Under 18 AAC 60.430(c)(1), the design must take into account the location of the seasonal high groundwater table, surface water, and continuous permafrost, as well as proximity to human population and to public water systems, with the goal of avoiding any adverse effect on these resources. The facility must be designed to prevent the escape of drilling waste and leachate; be of the minimum volume necessary for drilling waste disposal and emergency relief volume; prevent overflow from, or damage to, containment structures or other waste management areas, from operations, annual average precipitation, wind or wave action; ensure that drilling waste, leachate, or eroded soil from the facility does not cause a violation of applicable water quality standards at the surface water point of compliance or at the uppermost aquifer at the groundwater point of compliance. The plans for the proposed design and construction of the drilling waste disposal facility and the fluid management plan must be approved, signed, and sealed by a registered engineer per 18 AAC 60.430(c)(5).

Presently, the preferred practice is to dispose of drilling fluids by reinjection deep into the ground; however, EPA and ADEC may authorize limited discharge of waste streams under the NPDES permit system. All produced waters must be re-injected or treated to meet Alaska Water Quality Standards before discharge. Before a well may be permitted under 20 AAC 25.005, a proper and

appropriate reserve pit, also known as a solid waste disposal cell, must be constructed or appropriate tankage installed for the reception and confinement of drilling fluids and cuttings, to facilitate the safety of the drilling operation, and to prevent contamination of freshwater and damage to the surface environment (20 AAC 25.047).

Typically, a reserve pit is a containment cell lined with an impermeable barrier compatible with both hydrocarbons and drilling mud. Average dimensions are approximately 130 feet wide by 150 feet long by 12 feet deep, although specific configurations vary by site. The cell may receive only drilling and production wastes associated with the exploration, development, or production of crude oil, natural gas or hydrocarbon-contaminated solids. The disposal of hazardous or other waste in a containment cell is prohibited. After the well is deepened, the residue in the reserve pit is often dewatered and the fluids are injected into the well annulus. An inventory of injection operations including volume, date, type, and source of material injected must be maintained. Following completion of well activities, the material remaining in the pit is permanently encapsulated in the impermeable liner. Fill and organic soil is placed over it and proper drainage is re-established. Surface impoundments within 1,500 feet are sampled on a periodic basis and analyzed. In addition, groundwater-monitoring wells are drilled and sampled on a regular basis. If there are uncontained releases during operations, or if water samples indicate an increase in the compounds being monitored, additional observation may be required.

Substances proposed for disposal that are classified as “hazardous” undergo a more rigorous and thorough permitting and review process by both ADEC, per 18 AAC 62 and 63, and the EPA.

3. Wastewater Disposal Permit

Domestic graywater must be disposed of properly at the surface and requires a Wastewater Disposal Permit per 18 AAC 72. Typically, waste is processed through an on-site plant and disinfected before discharge. ADEC sets fluid volume limitations and threshold concentrations for biochemical oxygen demand (BOD), suspended solids, pH, oil and grease, fecal coliform, and chlorine residual. Monitoring records must be available for inspection, and a written report may be required upon completion of operations.

4. NPDES Certification

ADEC participates in the federal National Pollution Discharge Elimination System (NPDES) program that is administered by EPA (see below). ADEC certifies that discharges permitted under NPDES meet state and federal water quality standards. When an application for an NPDES permit is made to EPA, a duplicate must also be filed with ADEC for certification. The permit may impose stipulations and conditions on the facility and operations, such as monitoring and/or mixing zone requirements. Once operations begin, both EPA and ADEC have the responsibility to monitor the project for compliance with the terms of the permit.

Both EPA and require opportunities for public participation (40 CFR 124.10 - .14; 18 AAC 15.140; 18 AAC 15.150).

EPA administered the NPDES program in Alaska, but on October 31, 2008, EPA approved the state’s application to assume issuing and enforcing permits for wastewater discharges issued under the Clean Water Act. Transfer of authority for the program will be phased in over three years, from November 2008 – November 2011; authority for oil and gas facilities will be transferred to ADEC by 2011 (ADEC 2008b; SOA 2008).

5. U.S. Army Corps of Engineers Section 10 and Section 404 Permit Certification

ADEC participates in the permit review process for U.S. Army Corps of Engineers Section 10 and Section 404 permits (see Section F(1)) by reviewing permit applications to ensure that proposed projects will comply with Alaska water quality standards. If it is determined that the project will comply, ADEC issues a Clean Water Act Section 401 Certification for the project.

6. Oil Discharge Prevention and Contingency Plan

Pursuant to laws and regulations administered by ADEC, AOGCC must determine that evidence obtained through evaluation of exploration data demonstrates with reasonable certainty that the gas exploration wells will not penetrate a formation capable of flowing oil to the ground surface (AS 46.04.050; AS 31.05.030(l)). If that determination is made, gas wells are exempt from any requirement for an Oil Discharge prevention and Contingency Plan (C-Plan). If that determination cannot be made, licensees must comply with the requirements of AS 46.04.010 - .900, including the preparation and approval by ADEC of a C-Plan and other requirements under AS 46.04.

7. Review Process

Following receipt of an application for a solid waste disposal, wastewater, or air quality permit, ADEC must publish two consecutive notices in a newspaper of general circulation in the area affected by the proposed operation, as well as through other appropriate media. Comments must be submitted in writing within 30 days after the second publication and a public hearing may be requested. A hearing will be scheduled if good cause exists. Notice of a public hearing is handled in a manner similar to that of the initial application.

A decision on an application includes: (1) the permit; (2) a summary of the basis for the decision; and (3) provisions for an opportunity for an adjudicatory hearing (18 AAC 15). The decision, as conditioned, is sent to the applicant as well as each person, or entity, who submitted timely comments or testified at a public hearing. Permits may be valid for up to five years. Renewals are treated the same as the original application, but they do not receive public notice.

C. Alaska Department of Fish and Game

ADF&G, Division of Habitat, evaluates the potential effect of any activity on fish and wildlife, their habitat, and the users of those resources.

1. ADF&G Special Area Permit

For activities in a legislatively designated area (such as a game refuge, a game sanctuary or critical habitat area), a Special Area Permit is required (AS 16.20, 5 AAC 95). Currently, there are no legislatively designated areas in the Healy Basin license area.

2. Waters Important to Anadromous Fish and Fish Passage

The ADF&G, Division of Habitat administers the permitting process for activities that may affect anadromous fish streams. Under this program, a Fish Habitat Permit is required before using, diverting, obstructing, polluting, or changing the natural flow or bed of an anadromous fish water body as required in AS 16.05.871(b). A Fish Habitat Permit is likewise required for any activity that may affect the efficient passage of resident fish as per AS 16.05.841.

3. Review Process

Most permit actions subject to ADF&G require a 30-day review unless surface occupancy issues or other related permits require additional time. An informal review is conducted with the ADNR and

ADEC, as well as any affected coastal districts. Public notice of ADF&G permit actions is not required. Decisions are based upon recommendations provided by area staff, the commenting agencies and coastal districts. For permits issued for activities in anadromous streams, an applicant may appeal a rejection or stipulation through procedures described in the Administrative Procedures Act.

D. Alaska Oil and Gas Conservation Commission

AS 31.05, the Alaska Oil and Gas Conservation Act, created the Alaska Oil and Gas Conservation Commission (AOGCC). AOGCC acts to prohibit the physical waste of crude oil and natural gas, ensure a greater ultimate resource recovery, and protect the correlative rights of persons owning oil and gas interest in lands subject to Alaska's police powers. It also administers the Underground Injection Control (UIC) program for oil and gas wells in Alaska, and oversees metering operations to determine the quality and quantity of oil and gas produced in the state. AOGCC holds hearings and adjudicates decisions, which require the combined expertise of petroleum geology and petroleum engineering (AOGCC 2008).

The commission maintains programs to ensure that the drilling, casing and plugging of a well occurs in a manner that prevents: (1) escapement from one stratum into another; (2) the intrusion of water into an oil or gas horizon; (3) the pollution of fresh water supplies; and (4) blowouts, cavings, seepage and fires. For conservation purposes, the commission regulates certain aspects of the drilling, production, and plugging of wells in addition to well spacing, the disposal of salt water and oil field waste,and the contamination of underground water.

Reports, well logs, drilling logs, and other information must be filed with the commission for each well drilled. The information is confidential until the land from which the data were acquired is no longer subject to an exploration license, or, if converted to a lease, for two years after conversion or until the lease expires, whichever is first.

1. Permit to Drill

a. Permit Description

In order to drill a well for oil or gas in Alaska, a person must obtain a Permit to Drill from AOGCC. This requirement applies not only to exploratory, stratigraphic test, and development wells, but also to injection and other service wells related to oil and gas activities. AOGCC does not manage or decide whether to develop state owned resources. Rather, it regulates certain oil and gas operations anywhere in Alaska, whether on state, federal, or private land.

AOGCC’s oversight of drilling operations focuses on ensuring that appropriate equipment is used and appropriate practices are followed to maintain well control, protect groundwater, avoid waste of oil or gas, and promote efficient reservoir development. AOGCC is not authorized to deny a Permit to Drill on the basis of land use concerns or conflicts between surface and subsurface interests.

The permit application informs the commission of a proposed operator's engineering and safety plans designed to ensure the structural and mechanical ability of the well to contain fluids and gases that could be encountered at various depths and under varying pressure. A diagram of the proposed blow-out prevention (BOP) equipment (used for secondary well control) and an analysis of expected down-hole pressures must be included with the application. A BOP, along with related well-control equipment, must be installed, used, maintained and tested as necessary to assure control over the well and must conform to the latest technology and accepted industry practice.

Casing, cementing, and drilling fluid programs are also designed to ensure primary well control. A drilling fluid monitoring program must be in place to detect gases entrained in the drilling fluid and hydrogen sulfide, a poisonous gas.

For exploration wells, a well-site survey is conducted using seismic techniques. The data from the seismic survey are analyzed to detect shallow gas in near-surface strata to a depth of 2,000 feet and the depths of suspected overpressured strata are predicted. For offshore wells, an analysis of seafloor conditions is required.

If climatic conditions and operational or environmental concerns become apparent, or if unanticipated circumstances prevent the continuation of an approved program, an operator can secure a well and apply for an operational shut down. When a well is abandoned, plans for setting plugs, mudding, cementing, shooting, testing, and removing the casing must be submitted to AOGCC for approval. Wells may remain abandoned or suspended wells for long periods of time. Until final plans are made, the commission seeks to prevent the movement of fluids into or between freshwater and/or hydrocarbon sources.

AOGCC may not issue a permit to drill for nonconventional gas (coalbed methane) if the well would be used to produce gas from an aquifer that serves as a source of water for human consumption unless it determines that that the well will not adversely affect the aquifer (AS 31.05.030(j)). As a condition of approval of a permit to drill a well for production or production testing of coal bed methane, the commission requires the operator to design and implement a water well testing program to provide baseline data on water quality and quantity. The results of the water well testing program are made available to the public.

Before beginning to drill, an operator must post a bond for $100,000 in favor of the state for a single well, or $200,000 for a blanket bond covering more than one well. The purpose of the bond is to ensure that a well is properly completed or abandoned.

After abandonment, location clearance is required. For onshore locations, materials, supplies, structures, and installations must be removed, debris properly disposed of, and the reserve pit filled and graded. The location must be left uncontaminated, in a clean condition acceptable to state inspectors. Off-shore locations must have all casing, wellhead equipment, pilings, and other structures removed to a depth of 15 feet below the mud line.

AOGCC is one of several state agencies that has a role in reviewing and approving oil and gas activities. AOGCC's issuance of a Permit to Drill does not relieve the applicant of any obligations to comply with the permit or regulatory requirements of other state, local, or federal agencies before drilling (AOGCC 2008).

b. Review Process

A Permit to Drill from AOGCC is often the last step in the overall approval process, and usually all of the other concerned agencies have given their approval. The application must be accompanied by the items set out in 20 AAC 25.005(c). A geologist and a drilling engineer review the entire application in detail using a multi-question checklist to ensure the application is complete, accurate, and conforms to all applicable regulations.

AOGCC will notify the operator if there are any deficiencies in the application. The operator will either supplement the original application with revised or additional information, or, in the event that substantive changes are needed, resubmit the entire application. If unanticipated exceptions to regulations or AOGCC orders are needed, such as a well spacing exception, the operator will be notified. Usually such exceptions are handled through a public notice process, with an opportunity for a hearing. If the permit is approved, it will include any operational or environmental safety stipulations identified by AOGCC (AOGCC 2008).

2. Disposal of Wastes

AOGCC must also review and take appropriate action on proposals for the underground disposal of Class II oil field wastes (20 AAC 25.252). Before receiving an approval, an operator must

demonstrate that the movement of injected fluids into freshwater sources will not occur. Disposal or storage wells must be cased and the casing cemented in a manner that will isolate the disposal or storage zone and protect oil, gas, and freshwater sources.

Along with a plat showing the location of other wells within one-quarter mile, the disposal injection order application must include information about surface owners located within one-quarter mile of the injection well(s). The disposal injection order application must also contain the name, description, depth, thickness, lithologic description, and geological data of the disposal formation and adjacent confining zones. A description of the fluid to be injected, including composition, source, daily amount, and disposal pressures, and sufficient information and analysis, must be presented demonstrating that the disposal well will not initiate or propagate fractures through the confining zones that allow fluids to migrate. Under certain circumstances a freshwater aquifer exemption may be granted (20 AAC 25.440).

Following approval, liquid waste from drilling operations may be pumped into a well drill pipe, casing or annulus. The pumping of drilling mud from reserve pits (not runoff) into exploration or stratigraphic test wells or into the annuli of a well approved in accordance with 20 AAC 25.080 is an operation incidental to drilling of the well, and is not a disposal operation subject to regulation as a Class II well under EPA regulations.

3. Annular Injection

An AOGCC permit is required if fluid is to be injected into a well annulus (20 AAC 25.080). The material must be incidental to the drilling of a well (muds and cuttings). AOGCC may take all actions necessary to allow the state to acquire the primary enforcement responsibility for the control of underground disposal related to the recovery and production of oil and natural gas. ADEC considers the volume, depth, and other physical and chemical characteristics of the formation designated to receive the waste. Annular disposal is not permitted into water-bearing zones where dissolved solids or salinity concentrations fall below predetermined threshold limits. Waste not generated from a hydrocarbon reservoir cannot be injected into a reservoir.

4. Review Process

AOGCC actions that have statewide application, such as adopting regulations, are conducted in accordance with the Administrative Procedures Act. Major actions that result in conservation orders that apply to a single well or field receive public notice by publication in a newspaper and a public hearing may be held (20 AAC 25.540). In addition, a public mailing list is maintained for the purpose of sending appropriate notices, orders, and publications to persons who request to be put on these lists (20 AAC 25.545).

E. U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) protects human health and the environment by implementing, administering, or overseeing programs and regulations promulgated in federal environmental legislation. These programs, some of which are delegated to the states, safeguard the air, land, and water environments.

1. Air Quality Permits

The federal Clean Air Act includes a number of air quality standards and requirements, including National Ambient Air Quality Standards, New Source Review (NSR), New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants, and Prevention of Significant Deterioration. The two primary types of permits are issued to meet these requirements: Title I Construction Permits, which must be obtained before onsite construction can begin, and Title V Operation Permits, which regulate facilities that emit certain pollutants or hazardous substances.

ADEC administers an air quality program under a federally-approved State Implementation Plan that applies these standards. See Section B(1) in this chapter for further details.

2. Hazardous Waste (RCRA) Permits

The federal Resource Conservation and Recovery Act (RCRA) established a program for managing hazardous wastes to ensure the protection of human health and the environment, with the EPA as the regulatory authority. Regulations established by the EPA direct procedures for transporting, storing, and disposing of hazardous wastes, and for designing and operating treatment, storage, and disposal facilities safely. A corrective action program guides investigations and cleanups of contaminated air, groundwater, surface water, or soil. Regulations are enforced through inspections, monitoring of waste handlers, taking legal action for noncompliance, and providing compliance incentives and assistance (EPA 2008h).

States may receive authorization to implement the program, which requires that the state standards be at least as strict as the federal standards. Alaska is not authorized for this program, and therefore it is implemented by the EPA in Alaska.

3. NPDES Permit

a. Permit Description

Effluents discharged by the oil and gas industry into waters and wetlands are regulated through EPA's NPDES program as required by the federal Clean Water Act. The NPDES program, which covers other industries and waters as well, ensures that state and federal clean water quality standards are maintained by requiring a permit to discharge wastes into the nation's waters (EPA 2008j). NPDES permits specify the type and amount of pollutant, and include monitoring and reporting requirements, to ensure that discharges are not harmful to water quality and human health (EPA 2008f). Some permits may be subject to procedures of the National Environmental Policy Act (EPA 2008g). Alaska is in the process of gaining implementation authority for the program. EPA is scheduled to transfer authority for the program in phases over three years, from November 2008 – November 2011 (ADEC 2008b).

NPDES covers a broad range of pollutants, which are defined as "any type of industrial, municipal, and agricultural waste discharged into water" (EPA 2008j). Examples of oil and gas industry effluents regulated by NPDES include drilling muds, cuttings and wash water, deck drainage, sanitary and domestic wastes, desalination unit waste, blow-out preventer fluids, boiler blowdown, fire control system test water, non-contact cooling water, uncontaminated ballast and bilge waters, excess cement slurry, water flooding discharges, produced waters, well treatment fluids, and produced solids.

There are two basic types of NPDES permits: general permits and individual permits. General permits cover multiple facilities that are similar, for example, oil and gas facilities on the North Slope. General permits are efficient and cost effective because they eliminate redundancy of multiple permits for the same type of facility and discharges (EPA 2008j). They also ensure consistency among similar facilities. Individual permits apply to a specific facility and are tailored to that facility's characteristics. Individual permits are issued for a defined time period, not exceeding five years, and the facility must reapply for the permit before it expires (EPA 2008j).

b. Review Process

The process for issuing a general permit begins when it is determined that there is a group of facilities in an area that share similar characteristics and discharges. The permitting authority develops a draft permit and fact sheet, which documents the decision-making process for developing effluent limits (EPA 2008j). The permitting authority then issues a public notice, providing

opportunity for interested parties to submit comments on the draft permit. After considering public input, the permitting authority issues the final permit. The process for an individual permit is similar.

After a general permit is issued, facilities wishing to be included under the general permit submit a "Notice of Intent" to the permitting authority. Additional information describing the facility may be required. The facility may be notified that it is covered by the general permit or the facility may be required to apply for an individual permit (EPA 2008j).

c. Typical Permit Requirements

Only pre-approved discharges may be released and each must be emitted in accordance with an effluent limitation designed for that particular emission at that point of discharge. The permit may be modified or revoked after it is issued if new information justifies different conditions or if new standards are promulgated that are more stringent than those in the original approval. For example, existing permits prohibit discharges within 1,000 meters of river mouths, and specially designed monitoring programs are required within 1,500 meters of areas considered sensitive.

In all cases, mixing zones are established at the discharge point and produced waters are passed through at least one oil separator before discharge. Under certain conditions verification studies may be required of the mixing zone; discharge limitations are then applied as the emission passes through the mixing zone.

Only pre-approved drilling muds and specialty additives may be discharged and maximum concentrations are specified. For each mud system, a precise chemical inventory of its constituents is maintained. Free oil or oil-based muds (those containing oil as the continuous phase, with water as the dispersed phase) may not be discharged at any time. The oil content of a discharge must be analyzed: (1) at the time the fluid or additive is used; (2) when a drilling fluid could become contaminated with hydrocarbons from an underground formation; and (3) immediately when the static sheen test of a discharge indicates violation. Water-based drilling fluids that have contained diesel oil or cuttings associated with muds that contain diesel oil may not be discharged. In state waters, the discharge of cuttings with an oil volume greater than 5 percent by weight, or the discharge of free oil as a result of discharging drilling muds or cuttings is prohibited as well. A static sheen test is performed daily on emission samples, as well as prior to any bulk discharge. Generally, the discharge of floating solids or visible foam is not allowed. Surfactant, dispersant and detergent discharges are minimized, but may be allowed to comply with occupational health and safety requirements. In all cases, deck drainage and wash water must go through an oil/water separator; the effluent is tested and any discharge that would cause a sheen on the receiving waters is prohibited.

4. UIC Class I and II Injection Well Permits

EPA is responsible for regulating injection wells, which are used to dispose of fluid wastes by injecting the waste underground (EPA 2008i). Authorized as part of the federal Safe Drinking Water Act of 1974, EPA's Underground Injection Control (UIC) program protects underground sources of drinking water from contamination by injection wells. Injection wells are categorized into five classes; Class I and II are most common in the oil and gas industry. EPA may delegate authority for implementing the program to states that meet federal standards. Authority for Class II oil and gas wells has been delegated to AOGCC in Alaska (see Section D(2)); EPA implements the program in Alaska for Class I wells.

All injections falling into Class I must be authorized through EPA's UIC Class I program. Class I wells must operate under a permit that is valid for up to 10 years. Permits stipulate requirements such as siting, construction, operation, monitoring and testing, reporting and record keeping, and closure. Requirements differ for wells depending on whether they accept hazardous or non-hazardous wastes (EPA 2008i).

5. Spill Response Plan (C-Plan)

Owners or operators of non-transportation-related onshore facilities engaged in drilling, producing, gathering, storing, processing, refining, transferring, distributing, or consuming oil and oil products must prepare a spill prevention control and countermeasures plan (C-Plan) in accordance with 40 CFR § 112. The definition of facility includes drilling rigs and pipelines. The purpose of the C-Plan is to prevent discharges of oil into navigable waters of the U.S. and the adjoining shorelines. The plan must address three areas:

- operating procedures installed by the facility to prevent oil spills;
- control measures installed to prevent a spill from entering navigable waters; and
- countermeasures to contain, clean up, and mitigate the effects of an oil spill that impacts navigable waters.

The C-Plan is facility-specific and is part of the required documentation that must be present at the facility for inspection. The owner or operator must have the plan certified by a registered engineer but does not submit it to EPA for approval before the beginning of operations. If the facility discharges more than 1,000 gallons or harmful quantities of oil in one event or experiences more than two discharges in a twelve-month period, the operator must submit the C-Plan to the EPA and ADEC for review. The C-Plan differs from the facility response plans (FRP) required by the federal Oil Pollution Act of 1990 in that the C-Plan focuses on prevention and the FRP focuses on response.

It is not anticipated that natural gas operations will require C-Plans.

F. U.S. Army Corps of Engineers

1. Section 10 and Section 404 Permits

a. Permit Description

The U.S. Army Corps of Engineers (Corps) has regulatory authority over construction, excavation, or deposition of materials in, over, or under navigable waters of the United States, or any work which would affect the course, location, condition, or capacity of those waters (Rivers and Harbors Acts of 1890 [superseded] and 1899 [33 USC 401, et seq.; Section 10 [33 USC 403]; USACOE 2008b). Termed Section 10 permits, oil and gas activities requiring this type of authorization include exploration drilling from jack-up drill rigs and installation of production platforms.

Section 404 of the Clean Water Act established a program to regulate the discharge of dredged and fill material into waters and wetlands of the United States. This program is administered by the Corps, which is authorized to issue Section 404 permits for discharging dredge and fill materials.

Individual permits (issued for specific projects) are the basic type of permit issued. General permits (including programmatic, nationwide, and regional general permits) authorize activities that are minor and will result in minimal individual and cumulative adverse effects. General permits carry a standard set of stipulations and mitigation measures. Letters of permission, another type of project authorization, are used when the proposed project is minor, will not have significant individual or cumulative environmental impact, and appreciable opposition is not expected. The process for these authorizations is similar (USACOE 2008a, b).

b. Review Process

Section 404 and Section 10 permits follow a similar three-step review process: pre-application consultation (for major projects), formal project review, and decision making.

During the pre-application consultation, the applicant meets with Corps staff from the local district, interested resource agencies (federal, state, or local), and at times, interested public. These meetings provide informal discussions about the proposal before the applicant commits resources such as funds and detailed designs to the project; provide the applicant with possible alternatives and measures for reducing project impacts; and provide the applicant with information about factors the Corps considers in the permitting process (USACOE 2008a, b).

After receiving a formal application, the first step in the Corps' project review is to obtain public input, which is central to the permitting process. The project is public noticed, and comments and information are requested that will assist with evaluating the positive and negative effects on the public interest. Public hearings may be held if substantial issues are raised that warrant additional public input. USFWS, ADNR, and ADF&G may also submit comments to the Corps (USACOE 2008a, b).

Next, the Corps evaluates the project's impacts, considers all comments received, negotiates changes to the project as required, and drafts documentation supporting a recommended permit decision including environmental impacts of the project, findings of public input, and other special evaluations depending on the type of project (USACOE 2008a, b).

In making a final decision on whether to issue a permit, the Corps weighs all relevant factors, which can include conservation, economics, aesthetics, wetlands, cultural values, navigation, fish and wildlife values, water supply, water quality, and other factors judged important to the needs and welfare of the people (USACOE 2008a, b).

The process for letters of permission is abbreviated. In this situation, the proposal is coordinated with fish and wildlife agencies and adjacent property owners who might be affected by the project, but the public at large is not notified (USACOE 2008a, b).

ADEC participates in the permit review process by reviewing the permit application to ensure that the proposed project will comply with Alaska water quality standards. ADEC then approves of the permit through a Clean Water Act Section 401 Certification. Permits may also receive review by other agencies, such as the USFWS and NMFS, to ensure compliance with other laws such as the Endangered Species Act, the National Environmental Policy Act, and Essential Fish Habitat Provisions of the Magnuson-Stevens Act.

G. Pipeline and Hazardous Materials Safety Administration

The federal Office of Pipeline Safety (OPS) in the Pipeline and Hazardous Materials Safety Administration (PHMSA), an agency of the U.S. Department of Transportation, is responsible for regulating movement of hazardous materials by pipe (PHMSA 2008). OPS develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities (PHMSA 2008). Alaska is not a member of OPS' national pipeline inspection and enforcement program.

H. Denali Borough

The Denali Borough has adopted regulations requiring that gas exploration facilities be set back from a recorded private property line (9 DBC 25.010). Drill pads must be set back 500 feet and compressor stations 1,500 feet. Variances are allowed if the operator obtains written consent of the landowner(s) adjoining the setback. Approval is also required from the Denali Borough. In addition, at least one public hearing must be held prior to securing a variance.

I. Other Requirements

1. Native Allotments

Licensees must comply with applicable federal law concerning Native allotments. Activities proposed in a plan of operations must not unreasonably diminish the use and enjoyment of lands within a Native allotment. Before entering onto lands subject to a pending or approved Native allotment, licensees must contact the Bureau of Indian Affairs (BIA) and the Bureau of Land Management (BLM) and obtain approval to enter.

2. Rehabilitation Following License Expiration

Upon surrender or termination of any licensed land or portion of licensed land, paragraph 14 of the draft license requires the licensee to deliver the licensed land in good condition. The licensee is granted one year from the date of expiration or termination to remove all machinery, equipment, tools, and materials from the area. At the option of the state, all improvements such as roads, pads, and wells must either be abandoned and the sites rehabilitated by the licensee to the satisfaction of the state, or be left intact and the licensee absolved of all further responsibility as to their maintenance, repair, and eventual abandonment and rehabilitation.

3. Applicable Laws and Regulations

In addition to existing laws and regulations applicable to oil and gas activities, DO&G requires, under paragraph 19 of the draft gas only exploration license, that licenses be subject to all applicable state and federal statutes and regulations in effect on the effective date of the license. The license will also be subject to all future laws and regulations placed in effect after the effective date of the license to the full extent constitutionally permissible and will be affected by any changes to the responsibilities of oversight agencies.

J. References

ADEC (Alaska Department of Environmental Conservation)
2008a Division of Air Quality information. http://www.dec.state.ak.us/air/ Accessed July 22, 2008.

ADEC (Alaska Department of Environmental Conservation)
2008b NPDES Primacy Program. Division of Water. http://www.dec.state.ak.us/water/npdes/index.htm Accessed August 26, 2008.

AOGCC (Alaska Oil and Gas Conservation Commission)
2008 Commission functions and processes. http://www.aogcc.alaska.gov/functions/OvrSurvIndex.shtml#UIC Accessed August 27, 2008.

EPA (Environmental Protection Agency)
2007 The plain English guide to the Clean Air Act. Office of Air Quality Planning and Standards, Publication No. EPA-456/K-07-001. http://www.epa.gov/air/caa/peg/

EPA (Environmental Protection Agency)
2008a Air permits homepage. Air Quality in the Pacific Northwest and Alaska. http://yosemite.epa.gov/R10/AIRPAGE.NSF/webpage/Air+Permits+Homepage Accessed July 24, 2008.

EPA (Environmental Protection Agency)
2008b National Ambient Air Quality Standards (NAAQS). Air and Radiation. http://www.epa.gov/air/criteria.html Accessed August 25, 2008.

EPA (Environmental Protection Agency)
2008c National Emission Standards for Hazardous Air Pollutants (NESHAP). Technology Transfer Network, Air Toxics Website. http://www.epa.gov/ttn/atw/mactfnlalph.html Accessed August 25, 2008.

EPA (Environmental Protection Agency)
2008d New Source Performance Standards. Region 7 Air Program. http://www.epa.gov/region07/programs/artd/air/nsps/nsps.htm Accessed August 25, 2008.

EPA (Environmental Protection Agency)
2008e New Source Review (NSR). New Source Review. http://www.epa.gov/nsr/info.html Accessed August 25, 2008.

EPA (Environmental Protection Agency)
2008f NPDES permit program basics: Frequently asked questions. National Pollutant Discharge Elimination System. http://cfpub1.epa.gov/npdes/faqs.cfm?program_id=45#119 Accessed April 23, 2008.

EPA (Environmental Protection Agency)
2008g Other federal laws. National Pollutant Discharge Elimination System (NPDES). http://cfpub1.epa.gov/npdes/fedlaws.cfm?program_id=45 Accessed August 28, 2008.

EPA (Environmental Protection Agency)
2008h Resource Conservation and Recovery Act (RCRA) Subtitle C: managing hazardous waste from cradle to grave. Region 10: The Pacific Northwest. http://yosemite.epa.gov/R10/OWCM.NSF/webpage/Resource+Conservation+and+Recovery+Act+(RCRA)+Subtitle+C:+Managing+Hazardous+Waste+from+Cradle+to+Grave?OpenDocument Accessed August 27, 2008.

EPA (Environmental Protection Agency)
2008i Underground injection control program. http://www.epa.gov/safewater/uic/index.html Accessed August 27, 2008.

EPA (Environmental Protection Agency)
2008j Water permitting 101. Office of Wastewater Management - Water Permitting. http://www.epa.gov/npdes/pubs/101pape.pdf Accessed April 23, 2008.

PHMSA (Pipeline and Hazardous Materials Safety Administration)
2008 Pipeline and Hazardous Materials Safety Administration. U.S. Department of Transportation. http://www.dec.state.ak.us/spar/perp/grs/home.htm Accessed August 28, 2008.

SOA (State of Alaska)
2008 Alaska water permit program approved. Office of the Governor, Press Release No. 08-177, October 31, 2008. http://www.gov.state.ak.us/archive.php?id=1541&type=1 Accessed December 17, 2008.

USACOE (U.S. Army Corps of Engineers)
2008a Do I need a permit? Alaska District. http://www.poa.usace.army.mil/reg/NeedPermit.htm Accessed August 26, 2008.

USACOE (U.S. Army Corps of Engineers)
2008b Regulatory program overview. Alaska District. http://www.poa.usace.army.mil/reg/regover.htm Accessed August 26, 2008.

Chapter Eight: Reasonably Foreseeable Effects of Licensing

Table of Contents

List of Tables

List of Figures

Chapter Eight: Reasonably Foreseeable Effects of Licensing

Until exploration begins is issued and discoveries are made, DO&G cannot predict whether or when any activities might occur, or the type, location, duration, or level of those potential activities. In addition, methods to explore for, develop, produce, and transport gas resources will vary depending on the location and discovery. Best interest findings are not required to speculate about such possible future effects (AS 38.05.035; AS 38.05.180(d)). Consequently, this best interest finding does not speculate about possible future effects subject to future permitting that cannot reasonably be determined until the project or proposed use is more specifically defined. The effects of future exploration, development, or production will be considered at each subsequent phase, when government agencies and the public review permit applications for specific activities proposed at specific locations in the license, or lease if the license is converted to a lease.

Issuing the license alone is not expected to have any effects, other than to provide initial revenue to the state. However, activities subsequent to the exploration license may have positive or negative effects. The state of Alaska as a whole, the Denali Borough, and local communities may experience the effects of gas development.

The gas only exploration license will be subject to mitigation measures listed in Chapter Nine and any subsequent activities will be subject to federal, state, and local laws and regulations (see Chapter Seven and Appendix B). No activities will occur without appropriate plans of operations and permits and site-specific and project-specific mitigation measures.

Strategies used to explore, develop, produce, and transport natural gas will vary, depending on factors unique to the license area, licensee, operator, and discovery. This chapter considers the range of impacts that may occur; however, even if development does take place, it is unlikely that activities will be extensive or wide ranging.

If commercial quantities of gas are located, construction of pipelines and other production and transportation facilities will be necessary. New roads may be required, and machinery, labor, and housing may be required to support project sites. Activities could include seismic surveys related to exploration, development, and production; environmental and other studies; excavation of material sites; construction and use of support facilities such as gravel pads, staging areas, roads, airstrips, pipelines, and housing; transportation of machinery and labor to the site; and construction of drill sites and ongoing production activities. Unintended occurrences such as spills of petroleum products and hazardous substances would also have effects. The mitigation measures and licensee advisories in Chapter Nine are designed to avoid, minimize, or mitigate most potentially negative effects of gas exploration and development. These general mitigation measures and licensee advisories address pollution, habitat degradation, and disturbance to fish and wildlife species, users of local resources, and local residents, In addition, project-specific and site-specific mitigation measures may be applied to specific exploration and development proposals if and when they are submitted for approval in plans of operations; many of these local, state, and federal statutes and regulations are listed in Chapter Seven and Appendix B. Implementation of any exploration and development program must meet the requirements of regulatory agencies before approval.

This chapter discusses potential impacts and measures to avoid, minimize, and mitigate those impacts. This chapter also addresses specific concerns raised by local residents at public meeting and in comments on the preliminary finding. Residents expressed concern about potential surface impacts like noise, setbacks from and other protections to private property; potential impacts to water quality and aquifers; and potential impacts to fish and wildlife habitat and recreation.

Discussions focus on natural gas, both conventional and non-conventional (coalbed methane). Although the geology of the Healy area suggests that gas is the most likely resource present in economic quantities, there still exists a remote possibility of finding oil. If this were to occur, the licensee must shut down operations and contact DO&G.

A. Effects on Land Estate Owners

1. Potential Effects on Land Estate Owners

a. Surface Use

See Chapter Three for a discussion of land estates and mineral estates. Area residents expressed concern about use of privately owned lands to support exploration and development of the mineral estate and impacts on property values. Operators are required to contact the surface owner of lands where activities are proposed and to make a good faith effort to negotiate a surface use agreement. If agreement cannot be reached, ADNR may allow the operator to post a bond (AS 38.05.130), but only if the operator demonstrates that a reasonable period of time has passed from the initial contact between the surface owner and operator, and the operator has made a good faith effort to reach an agreement. When determining the damage bond amount under AS 38.05.130, ADNR considers the current market value of the property, the potential duration of operations, the loss of use of the property during operations, potential cost of damage to existing surface improvements, crops, and timber. In addition, bond terms include provisions to ensure that any bond with a potential duration of greater than two years is periodically reviewed to ensure it remains set at a sufficient amount.

The licensee must submit a copy of the proposed plan of operations to all surface owners whose property will be entered, and to all owners of surface lands within a half mile of the proposed work site who can be reasonably identified and located based on records at the state Recorder's office and the borough tax records.

Seismic exploration is performed under ADNR land use permits. Standard conditions are imposed to protect habitat and water quality. Permit applicants must seek permission from landowners to enter private property; if no agreement can be reached, ADNR requires a bond.

b. Property Value and Setbacks

Mitigation measures require that drill pads be constructed at least 500 feet from occupied residences or community or institutional buildings and that compressor stations be sited at least 1,500 feet away. Exceptions are allowed if the operator obtains the consent of the owner or demonstrates that the drill pad and/or compressor station will be substantially hidden from view and that noise levels will not exceed ambient noise levels. Furthermore, the Denali Borough Code (DBC 9.25.010) specifies that drill pads must be sited at least 500 feet from any recorded private property line. Compressor stations are subject to a setback of 1,500 feet. Variances are allowed only with the approval of adjoining landowners and the Denali Borough assembly.

Permanent facilities are not allowed during the exploration phase. Facilities must be designed and operated to minimize sight and sound impacts in areas of residential, commercial, recreational, and subsistence use. A plan of operations must describe the licensee's efforts to avoid, minimize, or mitigate impacts on residential, commercial, and recreational areas.

c. Noise and Other Disturbance

Drilling a well may generate noise. When the well is completed, however, the noise ceases. Compressors and other equipment used to produce and process gas may also be noisy. Using machinery powered by electricity can reduce noise levels. Mitigation measures described above also require steps to prevent or minimize noise. In addition, the licensee is required to prepare a monitoring plan that considers potential noise.

Siting of facilities and activities may affect the local viewshed and may, for instance, require artificial lighting. Plan of operations may require the licensee to direct exterior lighting away from residential areas or to shield lighting. Lanscaping permanent facilities, locating facilities at the base of slopes and away from prominent features, and minimizing the size of structures will help mitigate visual impacts on residents and tourists.

2. Mitigation Measures and Other Regulatory Protections

Although unregulated activities subsequent to licensing (and leasing) could potentially have cumulative effects on property owners and surface users, measures in this best interest finding, along with laws and regulations imposed by other state, federal, and local agencies, are expected to avoid, minimize, and mitigate any potential effects.

Mitigation measures included in this best interest finding address protection of surface owners' rights and access, habitat, fish and wildlife populations, viewshed, and water and air quality. A complete list of mitigation measures and licensee advisories is found in Chapter Nine.

B. Effects on Water

1. Potential Effects on Water Quality

Water quality characteristics may be altered by gas exploration and development activities. Thermokarst erosion, snow compaction, water withdrawls, gravel mining, and spills have the potential to alter surface water characteristics. Improper disposal of drilling muds and produced water could impact water quality. It is important to note, however, that coalbed methane constantly vents gas naturally (CNGA 2009) and may gas may enter water wells in the region naturally.

a. Muds, Cuttings, and Produced Water

Byproducts of drilling activities may include muds and cuttings, produced water, and associated wastes. During drilling and after a well is in production, water comes to the surface mixed with cuttings, oil (if oil-based fluids are used), and gas and must be separated before further processing. Water produced from coalbed methane wells may be salty, with quality ranging from high (meeting state and federal water quality standards) to low quality. In some situations, these produced waters are used for beneficial uses (CBM 2004). Typically, a coalbed methane well produces large amounts of water, especially in the beginning; as drilling continues, the volume of water decreases and the volume of gas produced increases.

Drilling sometimes employs the use of carefully mixed fluids, called muds. Drilling muds are mostly water-based mixtures of clay and other earthen materials, such as almond husks, which are used to cool and lubricate the drilling bit, prevent the drill pipe from sticking to the sides of the hole and facilitate the drilling action, flush out cuttings within the well bore, seal off cracks in down-hole formations to prevent the flow of drilling fluids into these formations, and maintain reservoir pressure. Chemicals may be added to maximize the effectiveness of drilling and casing. Oil-based muds and synthetic-based muds may also be used, depending on the well depth, well diameter, and subsurface formations (NRC 1983; Veil et al. 1996). Technological advances in drilling mud systems have resulted in mud systems that are less toxic to the environment (NRC 2003). Newer synthetic-based muds produce even less waste, improve drilling efficiency, are reusable, and have advantages in environmental protection over oil or water-based muds (Wojtanowicz 2008). Synthetic muds are more expensive and are typically reconditioned instead of discharged (BLM 2008). Discharge of untreated oil-based muds into any water column violates federal and state pollution laws. Like drilling muds, chemicals may be added to produced water to remove harmful bacteria, halt corrosion, break up solids, and prevent buildup of scale (EPA 1995). Cuttings are small fragments of rock up to an inch across that are dislodged and carried to the surface by the drilling process, in the muds.

Associated wastes are other production fluids such as tank bottom sludge, well work-overs, gas dehydration processes, tank wastewater, and other residues that are considered non-hazardous (low-toxicity) by the EPA.

Surface disposal of produced water is not allowed unless ADEC determines the discharge will meet state water quality standards. An NPDES permit would also be required for surface disposal. Mitigation measures imposed on the license preclude discharging drilling muds and cuttings into lakes, streams, rivers, or important wetlands. Temporary cuttings storage will be allowed on pads. Impermeable lining and diking, or equivalent measures, will be required for reserve pits. Disposal of cuttings is either through on-site grinding and injecting, or through transport to an approved disposal site. Wastewater, including sanitary and domestic graywater, is also treated to meet effluent guidelines before discharge. Unless authorized by NPDES and state permits, disposal of wastewater into freshwater bodies is prohibited. To mitigate potential impacts on water quality and quantity, plan of operations approvals may include monitoring requirements which are tailored to the specific situation and potential impacts.

EPA regulates five classes of injection wells (EPA 2004b). Class II wells are for fluids brought to the surface in connection with gas development or that are used to enhance recovery. EPA has delegated that responsibility, regulating annular disposal of drilling waste, to AOGCC, and a permit is required prior to injecting any fluid into a well annulus. During the permitting process, AOGCC considers the volume, depth and other physical and chemical characteristics of the formation designated to receive the waste. Annular disposal is only permitted for wastes incidental to the drilling of a well (e.g. muds and cuttings), and is not permitted into water-bearing zones where dissolved solids or salinity concentrations fall below predetermined threshold limits. Waste fluids are recycled, filtered, and treated before reinjection or disposal. Produced water is treated to remove hydrocarbons, and then is reinjected either into an approved disposal well or into the hydrocarbon-bearing formation to maintain pressure and enhance recovery. Disposal wells inject fluids deep beneath any drinking water aquifers.

Potential contamination of drinking water by gas production has been studied by the EPA (EPA 2004a). In its review of incidents of drinking water well contamination believed to be associated with hydraulic fracturing (fluids injected into the well to enhance recovery of gas), EPA found no confirmed cases that are linked to fracturing fluid injection into coalbed methane wells or subsequent underground movement of fracturing fluids. Some Colorado residents have associated well water and health issues with coalbed methane wells. One county level study concluded water quality was naturally poor and natural methane occurred in some wells in high volumes; no direct link between drilling and water quality was found (CFWE 2007)

The federal Clean Water Act established National Pollutant Discharge Elimination System (NPDES) permits to regulate discharges of pollutants into U.S. waters by point sources, such as industrial and municipal facilities. Administration of NPDES permits is being transferred from EPA to ADEC over a three-year period. Permits are designed to maximize treatment and minimize harmful effects of discharges as water quality and technology improvements are made. ADEC certifies that these discharge permits will not violate the state's water quality standards.

ADEC also certifies U.S. Army Corps of Engineers permits to dredge and fill wetlands and navigable waters, to ensure compliance with state water quality standards. ADEC issues industrial and municipal wastewater permits and monitors wastewater discharges and the water quality of water bodies receiving the discharges. ADEC certifies federal wastewater permits with mixing zones that allow industrial and municipal facilities to meet state water quality standards. Industrial and municipal wastewater facilities are inspected annually. ADEC provides technical assistance for design, installation, and operation of industrial and municipal wastewater systems.

b. Seismic Exploration

Geophysical exploration with tracked seismic vehicles is not expected to alter water quality because seismic surveys are typically conducted in winter and permit conditions mitigate potential damage. The greatest potential for water quality impacts from winter seismic surveys is through thermokarst erosion and snow compaction (BLM 2005). Thermokarst results from impacts to the insulating vegetative layer, which allows the underlying permafrost to melt, resulting in soil erosion that impacts adjacent surface waters. Other potential impacts include snow removal and compaction, which increase the depth of frozen ice on surface waters, and in turn increase the salinity of the unfrozen water in lakes and streams. Under standard ADNR permit conditions for winter seismic exploration, tracked vehicles are used to mitigate potential environmental damage, and the use of ground-contact vehicles for off-road travel is limited to areas where adequate ground frost and snow cover prevent damage to the vegetation and ground surface. Equipment other than boats must not enter open water areas of a watercourse during winter, and any roads, bridges, or approach ramps constructed near river, slough, or stream crossings must be free of extraneous material before break-up. Alteration of the banks of a watercourse is prohibited. Adherence to these conditions avoids or minimizes post-seismic increases in erosion, turbidity, and suspended solids in a drainage area.

c. Spills

Water quality impacts from spills may occur during all phases of post-licensing activity. The extent and duration of water quality degradation resulting from accidental spills depends on the type of product, the location, volume, season, and duration of the spill or leak, and the effectiveness of the cleanup response. Heavy equipment, such as trucks, tracked vehicles, aircraft, and tank trucks, commonly use diesel fuel, gasoline, jet fuel, motor oil, hydraulic fluid, antifreeze, and other lubricants. Spills or leaks could result from accidents, during refueling, or from corrosion of lines. Under standard ADNR permit conditions for off-road activity, fuel and hazardous substances must have secondary containment apparatuses. A secondary containment or surface liner must be placed under all container or vehicle fuel tank inlet and outlet points. Appropriate spill response equipment must be on hand during any transfer or handling of fuel or hazardous substances. Vehicle refueling is prohibited within annual floodplains (ADGC 1995). Pipeline gravel pads must be designed to facilitate the containment and cleanup of spilled fluids. In addition, plans of operation include an emergency preparedness and response plan for potential emergencies such as spills of hazardous material.

This a gas only license and the likelihood of discovering oil is very low. However, to comply with ADEC regulations, AOGCC must determine that the exploration wells will not penetrate a formation capable of flowing oil to the ground surface. If that determination cannot be made, the licensee is required to have an approved oil discharge prevention and contingency plan (C-Plan) and determination of financial responsibility prior to commencing operations. The possibility of an oil spill, even a small, operational spill from vehicles, is considered extremely remote.

d. Water Use

Water withdrawals from lakes and ponds may be required for the construction of any ice roads and pads, for blending drilling muds in exploratory and production drilling activities, and for potable and domestic water uses at drilling camps. Withdrawals have the potential to affect water quality through changes in water chemistry and decreased circulation in shallow lakes affecting dissolved oxygen levels (BLM 2005). The construction of ice roads and pads may impact water quality by adding slightly saline water during spring melt to shallow lakes and diverting stream or lake flow, which can cause bank erosion and sedimentation.

e. Gravel Mining

Gravel mining for the construction of permanent roads and pads may impact water quality both during the gravel mining operation and after construction, through thermokarst and upslope impoundment. Gravel mining may be permitted within the active floodplain only if the Division of Mining, Land and Water (DMLW) and ADF&G determine that there are no feasible or prudent alternatives and that a floodplain mine site would enhance fish or wildlife habitat after mining operations are completed and the site is reclaimed and closed (McLean 2004). Dust blown off of gravel roads and pads darkens vegetation, increasing the heat absorption of the ground surface, melting permafrost and causing thermokarst. Thermokarst may impact water quality by altering water chemistry or by eroding mineral soil layers under the peat mat. Dust and thermokarst may increase the turbidity of surface waters adjacent to gravel pads and roads (BLM 2004). A plan of operations must consider whether dust control measures are necessary.

f. Well Blowout

There is a potential for a well blowout during exploration and production activities; a well blowout is considered highly unlikely. Further, as addressed in Chapter Six, coalbed methane wells include installation of blowout preventers during the drilling of the well. Nonetheless, if a blowout were to occur, it could have effects on water quality. Fires associated with blowouts, either unintentional or as a cleanup technique, would produce additional air contaminants that can settle and affect surface water quality. These emissions include NO_X, CO, SO_2 and particulate matter (BLM 2005).

2. Potential Effects on Aquifers

Most borough residents use groundwater from individual wells, and the UCM and Healy Clean Coal Project have individual water well systems (ADCED 2009). There is no borough-wide piped water and sewer system.

a. Groundwater Drawdown

Coalbed methane development has the potential to affect water resources through groundwater drawdown from the dewatering process and surface disposal of co-produced water. Under AS 31.05.030(j), AOGCC is tasked with specific responsibilities to protect drinking water aquifers from coalbed methane exploration and development. No well may be drilled without an AOGCC permit to drill, and the agency may not issue a drilling permit for a CBM well if the well would produce gas from an aquifer that is a source of water for human consumption or agriculture. An exception is allowed if AOGCC determines that the gas well will not adversely affect the aquifer. AOGCC may only approve underground injection of produced waters below these water sources. AOGCC also requires that a coalbed methane operator conduct baseline testing of potentially affected wells and establish a monitoring program. The data is available to the public.

b. Water Use

Permits may contain stipulations on water use and quantity drawn in order to meet standards related to protection of recreation activities; navigation; water rights; or any other substantial public interest. Water use permits may also be subject to conditions, including suspension and termination of exploration activities, in order to protect fish and wildlife habitat, public health or the water rights of other persons. Before a permit to appropriate water is issued, ADNR considers local demand and may require applicants to conduct aquifer yield studies. Generally, water table declines associated with the upper unconfined aquifer can be best mitigated by industrial users tapping confined (lower) layers or searching for alternate water sources.

3. Mitigation Measures and Other Regulatory Protections

Although unregulated activities subsequent to licensing (and leasing) could potentially have cumulative effects on water quality and aquifers, measures in this final best interest finding, along with laws and regulations imposed by other state, federal, and local agencies, are expected to avoid, minimize, and mitigate any potential effects.

Mitigation measures included in this best interest finding which address water quality include: protection of wetland, riparian, and aquatic habitats; monitoring of water quality and quantity; siting facilities away from fishbearing streams; prohibiting gravel mining in active floodplains; restrictions on disposal of produced waters; prohibiting disposal of muds and cuttings into lakes, streams, and wetlands; and requiring secondary containment during fuel transfers. In addition, licensees are advised that AOGCC cannot issue a permit to drill a coalbed methane well that will affect a drinking water aquifer and that surface disposal of produced water will not be alllowed unless ADEC determines that the discharge meets state water quality standards. Measures designed to protect water quality also protect the integrity of aquifers. A complete list of mitigation measures and licensee advisories is found in Chapter Nine.

C. Cumulative Effects on Air Quality

1. Potential Effects on Air Quality

Methane is a greenhouse gas, with 21 times the global warming potential of carbon dioxide. A positive effect of producing coalbed methane is the prevention of natural seeps or emissions during coal mining. (NETL 2009). Producing coalbed methane may actually reduce methane emissions by removing gas that is otherwise released during mining (USGS 2000)

Emissions from routine activities during gas exploration, development, and production could potentially affect air quality. Specific sources of emissions include vehicular traffic, heavy equipment, drill rig engines, camp generator engines, steam or propane generators, waste oil burners, hot-air heaters, incinerators, and well test flaring equipment. Airborne emissions could be temporarily elevated during the construction phase due to increased construction and vehicular traffic; it is anticipated that these elevated levels would diminish after the construction phase is complete. Measures prevent the construction of new facilities during the exploration phase, require use of existing roads and trails, require traffic route plans to avoid rural residences, and consideration of dust control measures will help minimize or mitigate dust, the most likely potential source of air pollution during exploration.

Other sources of air pollution include evaporative losses of volatile organic compounds (VOC) from tanks, pump, compressor seals, and valves. Methane (natural gas) is sometimes considered a VOC. Venting and flaring could be an intermittent source of VOC and sulfur dioxide (MMS 2008). Gas blowouts, if one were to occur, may also affect air quality. Gas blowouts may ignite and a fire could deposit a light, short-term coating of particulates over a localized area. The probability of a gas blowout is considered low. If a gas blowout did occur, it is estimated that it would not persist more than 1 day and that it would release less than 2 tons of volatile organic compounds (MMS 2003). AOGCC (20 AAC 25.066) requires methane gas detection systems for wells, at three specified sensing points. Mud pits may require a fourth sensor.

Greenhouse gas emissions (CO_2 and CH_4) are another potential source of air pollution. These emissions come primarily from burning fossil fuels in generators, vehicles, heavy construction equipment, aircraft, and camp operations, as well as the flaring and venting of natural gas. Fugitive emissions include methane and carbon dioxide released from leakage and venting at gas fields, processing facilities, and pipelines.

Because industrial emissions can have negative environmental effects, the federal Clean Air Act of 1970 and subsequent amendments regulate air quality across the U.S., including in Alaska. Although the EPA is the primary federal agency responsible for controlling air pollution, monitoring air quality, and inspecting facilities (EPA 2007), many of these authorities in Alaska have been delegated to ADEC under a federally-approved State Implementation Plan (ADEC 2008). State and federal regulations require facilities that emit certain pollutants or hazardous substances to obtain a permit: new facilities are required to obtain a permit before construction (Title I, NSR permit); existing facilities must have an operating (Title V) permit. Permits are legally binding and include enforceable conditions. The permit limits the type and amount of emissions and requires pollution control devices, prevention activities, monitoring, and record keeping (EPA 2008b). Ambient concentration limits for the protection of human health were established for six criteria pollutants: carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, and particulate matter (two particulate sizes are regulated: less than 2.5 and less than 10 micrometers). These six criteria pollutants are used as indicators of air quality, as they tend to show up wherever air quality is poor (EPA 2008a). There are no areas within the Healy Basin designated by the EPA as a non-attainment area for any of these pollutants.

EPA's Air Toxics program regulates an additional 188 air pollutants that are known or suspected to cause cancer or other serious health effects. These pollutants come from a variety of sources, including benzene, which is found in gasoline, and methylene chloride, which is used as a solvent. EPA has issued regulations for many of the commercial and industrial sources, including natural gas production, to reduce air toxics emissions.

ADEC operates ambient air quality monitoring networks to assess compliance with the National Ambient Air Quality Standards (NAAQS) for carbon monoxide, particulates, nitrogen dioxide, sulfur oxide, and lead; assesses ambient air quality for ambient air toxics level; provides technical assistance in developing monitoring plans for air monitoring projects; and issues air advisories to inform the public of hazardous air conditions (ADEC 2008). 18 AAC 50 provides for air quality control including permit requirements, permit review criteria, and regulation compliance criteria. The Healy area is classified as Class II and an air quality attainment area. The Class II designation allows a moderate incremental decrease in the air quality of the area. Baseline concentrations of pollutants and portions of the increments already consumed are determined by the EPA and the state of Alaska prior to issuing air quality permits.

Operators in Alaska are required to minimize the volume of gas released, burned, or permitted to escape into the air (20 AAC 25.235(c)). Operators must report monthly to AOGCC any flaring event lasting over an hour. AOGCC investigates these incidents to determine if there was unnecessary waste (AOGCC 2004). Additional information about air quality regulations and permits is found in Chapter Seven.

2. Mitigation Measures and Other Regulatory Protections

Natural gas activities subsequent to licensing could potentially affect air quality. Although it is not possible to predict at the licensing stage the amount or type of pollutants that may be produced, all industrial emissions must comply with federal and state air quality laws and regulations, particularly the Clean Air Act (42 USC §§ 7401-7661), 18 AAC 50, and AS 46.14. These laws and regulations are expected to avoid, minimize, and mitigate those potential effects. Therefore, additional mitigation measures are not being imposed on the license.

D. Cumulative Effects on Fish and Wildlife Habitats and Populations

1. Potential Effects on Fish and Wildlife Habitats and Populations

Potential post-license activities that could have cumulative effects on terrestrial and freshwater habitats, fish, wildlife, and birds of the license area include seismic surveys and other exploration activities. If the license is converted to a lease, further development, namely construction of support facilities, drilling, and production, could occur. If unmitigated, potential effects of these activities could potentially alter the landscape, lakes, rivers, and wetlands; disturb habitat; change behavior in fish, wildlife, and birds; drawdown or contaminate groundwater; and contaminate habitats from discharges from well drilling and production, gas blowouts, or spills of hazardous substances.

Effects of industrial activities on birds, fish, and wildlife depend on the species, time of year, and the age or reproductive state of the species, as well as the disturbance type, intensity, and duration. Cumulative adverse effects from gas activities could result from direct habitat loss, barriers to movement, noise, and disturbance at critical periods like calving, nesting, or denning, and pollution of the terrestrial and aquatic environments. Birds could collide with structures; moose and caribou could collide with vehicles; bears could be attracted to human garbage. In Arctic environments, the largest effects of oil and gas activities are from physical disturbances (Huntington 2007). However, there is little information on these effects specific to the Healy region. There are studies on effects of oil and gas activities on Arctic habitats and wildlife, but the habitats of the Healy region area differ in many respects from those of the Arctic tundra, as does the likely level and intensity of gas-related activities. In addition, this is a gas only license, whereas most other petroleum exploration and development in Alaska is for oil and gas.

The licensee may be required to include a monitoring plan in any plan of operations. Monitoring plans consider potential impacts to fish and wildlife populations and proximity to sensitive habitats.

Water quality is discussed in the section on Effects on Water.

a. Geophysical Exploration

Seismic surveys are typically conducted in the winter to minimize environmental impacts. Seismic trails, camp move trails, and trails made by vehicles traveling to and from the camp (if one is needed) have the potential to impact vegetation depending on snow depth, vehicle type, traffic pattern, and vegetation type. By conducting land-based seismic surveys in the winter, the frozen ground and snow pack reduce the impact to vegetation. However, winter seismic trails do have the potential to compress microtopography, which could result in an overall wetter environment (NRC 2003). Such a change in hydrology can impact resident species, resulting in a change to more water-tolerant species.

Modern seismic surveys may also use satellite and navigational technology such as the global positioning system (GPS) to minimize impacts to terrestrial environments. By using GPS, surveyors no longer need long clear-cuts of trees and brush for line-of-sight measurements. Some areas may be accessed by helicopter, which minimizes the disturbance of vegetation and sensitive environments.

Activities such as seismic surveys that require creation of linear corridors may affect habitat and behavior of wildlife. Traditional seismic lines leave a long-lasting footprint in boreal forests. Plant communities on seismic lines are significantly different from adjoining forests, and seismic lines show little change for up to 30 years (MacFarlane 2003). The slow recovery rate may be due to factors such as damage to root systems by bulldozers and competition from grass species (Schneider 2002). Heavy equipment may result in soil compaction and erosion, and cratering may occur from improperly filled shot holes (Schneider 2002). Increased access for all-terrain vehicles, snow

machines, and off-road trucks, and continued use of the lines by these vehicles may also contribute to extended recovery times (Schneider 2002). Studies have shown that low impact lines do not recover any faster, and the length of time for natural plant communities to be restored on low impact lines is unknown (MacFarlane 2003). Bog habitats that have been disturbed may take many years to return to their pre-disturbance state naturally (ADF&G 2006).

Clearing operations may be necessary, particularly in portions of the license area dominated by woody vegetation. Clearing involves chipping vegetation or felling and removing trees and undergrowth from an area; grubbing involves removal of roots and other vegetation within the same area. Clearing to prepare seismic lines, and explosions that occur during seismic surveys, may disturb wildlife. Birds and wildlife are particularly sensitive during nesting and calving periods (Schneider 2002). Repeated disturbances can result in increased movement rates of wildlife and subsequent significant energy losses, which can be particularly problematic during winter when food supplies may be scarce (Schneider 2002).

Loss of forest habitat that occurs when seismic lines are cleared is magnified by fragmentation, which reduces the usefulness of the habitat, and by avoidance of intact habitat in the area of the seismic lines by some species such as caribou (Schneider 2002). For example, use of habitat within 100 m of seismic lines during late winter by woodland caribou (*Rangifer tarandus caribou*) was about half the expected use, and use was also less than expected during calving, summer, rut, and early winter (Dyer et al. 2001).

Seismic lines may alter predator-prey interactions. In boreal forests, tracked radio-collared wolves were significantly closer to linear corridors, and they traveled faster along linear seismic corridors than in the forest (James 1999). Travel speed was unrelated to whether the seismic line was packed or unpacked, so it is suspected that the visual stimulus of a long distance influences wolves to stay and follow the corridor when they intersect it. Caribou mortalities from wolf predation were closer to linear corridors relative to locations of live caribou, but the sample size of tracked caribou was only 5 animals (James 1999). Researchers speculate that creation of linear corridors may increase caribou mortality by facilitating wolf movement, but this has not been proven conclusively through research (James 1999).

Seismic exploration is performed under ADNR land use permits. Standard condidtions are imposed to protect habitat and water quality from potential negative effects. Work areas must be kept clean. Trash, survey markers, and other debris that may accumulate in camps or along seismic lines and travel routes that are not recovered during the initial cleanup must be picked up and properly disposed of. All solid wastes, including incinerator residue, must be backhauled to a solid waste disposal site approved by ADEC. Permit stipulations include setbacks for lakes and rivers, and permit applicants must seek permission from landowners to enter private property.

b. Facility Construction

No permanent facilities are permitted during the exploration phase and activities are restricted to existing roads; ice or snow roads are permitted. If the license is converted to a lease, subsequent development and production may require the construction and continued use of support facilities such as roads, production pads, pipelines, and other facilities. In addition to clearing of trees, these may also require gravel infilling, and impoundment and diversion of water. Support facilities may result in many of the same effects as seismic lines, except that human activity, vehicle traffic, and aircraft activity associated with support facilities continue for the life of the field.

Clearing vegetation and constructing gravel roads and pads in the license area could result in a direct loss of habitat. Studies on the North Slope indicate that ice roads recover naturally with no long-term environmental effects, including in areas crossing wetlands. Upland vegetation may be susceptible to

damage if it is encased in ice during ice road construction, but over the long-term there is virtually no impact (Guyer and Keating 2005).

Water impoundment along gravel roads and pads can create inundation upgradient and drier habitat downgradient. These effects may be beneficial. For example, impoundments from roads may change drainage patterns, creating additional habitat for water birds such as ducks or geese. In addition to changes in species composition related to water impoundment and drainage, the construction of facilities may allow the re-vegetation of disturbance-colonizing species such as fireweed (*Epilobium angustifolium*).

Some limited information is available concerning effects of support facilities on species in other regions. For example, in one study, caribou used habitat near roads less than habitat farther away, ranging from 0% of expected use in closed coniferous wetlands in late winter to about 34% during summer in open coniferous wetlands (Dyer et al. 2001). Caribou also avoided well sites at some distances and seasons, although expected use was greater than 100% for others (Dyer et al. 2001). Cumulative effect of avoidance of all industrial development was a potential loss of 48% of the 617,204 ha study area (Dyer et al. 2001). However, studies of caribou in northern Alaska before and after construction of a road showed no significant differences in densities of caribou near the road (Noel et al. 2004), and pipelines elevated ≥1.5 m were found to not cause changes in caribou use or delay migrations (Noel et al. 2006). In addition, despite concerns that oil and gas development and infrastructure such as roads may displace caribou, sizes of caribou herds in northern Alaskan oilfields have increased from 5,000 to 32,000 animals since oilfield development began, and recent studies indicate that negative effects from displacement are absent or negligible (Noel et al. 2004; Haskell et al. 2006).

Secondary effects of new road construction and use could include dust deposition, which may reduce photosynthesis and plant growth, and downstream siltation and sedimentation, which can affect plant viability. Consequently, plans of operation must consider the necessity of dust controls. Road construction and vehicular traffic can alter surface albedo (reflectivity of sunlight off the earth's surface) or water drainage patterns, resulting in thaw and subsidence or inundation. Such changes can affect regeneration and revegetation of certain species, and species composition may also change after disturbance from construction activities (Linkins et al. 1984).

Extension of development into brown bear habitat is of concern to wildlife managers (ADF&G 2007) but little direct research is available on the effects of industrial development on brown bear populations. However, a study of frequency and distribution of highway crossings by brown bears on the Kenai Peninsula found that highways affected brown bear travel patterns (Graves et al. 2006). A study of the effects of roads on brown bears in British Columbia and Montana found that bears used areas within 100 m of roads significantly less than areas farther from the roads, but this behavior change did not translate into a demonstrable effect on the population (McLellan and Shackleton 1988). However, of greater concern to wildlife managers in some areas is the potential for increased bear-human interactions and potential subsequent high non-hunting mortality of bears resulting from those interactions (ADF&G 2007; Suring and Del Frate 2002).

If activities associated with oil and gas exploration and development, such as gravel removal, heavy equipment operations, and siting of support facilities, are unregulated, they could increase stream sedimentation and erosion, impede fish passage, alter drainage patterns, and have other negative effects on freshwater habitats, fish, and other aquatic organisms (Schneider 2002). Erosion can increase sedimentation and turbidity of aquatic habitats, which can cause decreased primary production, resulting in depleted food for fish. This can lead to direct mortality, reduced physiological function, and depressed growth rates and reproduction in aquatic organisms (Henley et al. 2000). Excess turbidity and sedimentation can also decrease recreation value (USGS 2008). Activities that may impede fish passage include culvert installation, stream realignment or diversion,

dams, low-water crossings, and placement or removal of any material below the ordinary high water mark.

Alternatively, gravel mine sites can be restored as overwintering habitat and thus add to total available fish habitat; gravel mining with an active floodplain is prohibited, unless the director, with the concurrence of ADF&G, determines that the site would enhance fish and wildlife habitat when the site is closed and reclaimed. Gravel mining at upland sites will be restricted to the minimum area necessary. The siting of temporary and permanent facilities, other then docks, roads, and utility and pipeline crossings, will be prohibited with a half mile of the Nenana and Savage rivers and within 500 ft of fishbearing waterbodies.

Wetlands provide many key ecological functions within the license area, including floodwater storage, sediment and pollutant filtration, erosion control, nutrient production, and fish and wildlife habitat. Degradation or isolation of wetland areas may affect entire watersheds and associated organisms. Although efforts are made to avoid wetlands during exploration and development, it may be necessary to develop certain wetlands. The discharge of dredge or fill material affecting wetlands requires a Clean Water Act Section 404 permit from the Corps of Engineers and, depending on the activity, may require additional action from EPA and the state. Impacts to important wetlands must be minimized to the satisfaction of the director, in consultation with ADEC and ADF&G. Disposal of muds and cuttings into wetlands is prohibited.

Water withdrawals from lakes and ponds may be required for the construction of ice/snow roads and pads, for blending drilling muds during exploratory and production drilling activities, and for potable and domestic water uses for drilling camps. Withdrawal of water from lakes and ponds could affect fish resources by entraining juvenile fish, lowering water levels in overwintering areas, and stressing populations by increasing disturbance. Inadequate water levels may also impede the ability of fish to reach overwintering habitat. Water withdrawal is discussed earlier in this chapter.

The construction of permanent facilities may damage habitat through such indirect measures as surface water impoundment, thermokarsting, and blowing dust from gravel roads and pads. Some habitat loss is actually compensated through the construction of new buildings and structures. Passerines and some ravens and species of raptors are known to use man-made structures for nesting. The Migratory Bird Treaty Act protects these birds from disturbance after nesting has begun, even if they are nesting on man-made structures.

The Healy Basin is a known moose winter concentration area and the loss of winter habitat in riparian areas could impact local moose populations. Additional pressure on adjacent habitats could also occur from the displacement of animals around natural gas facilities due to noise and activity. Movement to critical areas, such as wintering and calving grounds, is not anticipated to be adversely affected. However, activities within these areas, especially during the winter, could affect moose foraging and browsing behavior and cause movement to less desirable habitats. Mitigation Measure 16 allows seasonal restrictions to protect moose.

c. Pipelines

Elevated or buried flow, gathering, and common carrier pipelines would carry natural gas from wellheads to processing centers and to market. Elevated pipelines can restrict wildlife movements, especially if accompanied by a road with regular vehicle traffic. Buried pipelines have little impact on wildlife but cannot be visually inspected. Elevated pipelines are easy to maintain and visually inspect for leaks. If any portion of a pipeline were to be elevated, a small amount of vegetation would be permanently displaced by the installation of vertical support members and vegetation would be cleared within the right of way. Adjacent vegetation would be potentially altered in terms of species composition (e.g. introduction of disturbance tolerant species or a change in the moisture regime).

If a buried pipeline is constructed, a larger area of vegetation would initially be disturbed due to trenching requirements. Trenched areas would be revegetated after installation of the pipeline. In both cases the right of way would be maintained to allow access for maintenance, keeping the vegetation in an early successional stage. All revegetation efforts should utilize local native vegetation to avoid impacts from introduced species. Pipelines must utilize existing transportation corridors and be buried where conditions permit. In areas with above ground placement, they must be designed, sited, and constructed to allow for the free movement of wildlife. Pipeline gravel pads must be designed to facilitate the containment and cleanup of spilled fluids. Pipelines must be designed and constructed to assure integrity against climatic conditions and geophysical hazards. Pipelines that must cross fish streams will be constructed beneath the fish streams using directional drilling techniques, unless the director, in consultation with ADF&G, approves an alternative method.

d. Noise and Other Disturbances

Bald eagle populations could be affected by disturbance or removal of their nesting habitat, and by disturbances to their nests (ADF&G 2003). Disturbances by floatplanes, sport anglers, and other recreationists could force loons to abandon their nests, allowing the chicks to chill and die (ADF&G 1994). There is little direct research concerning effects of oil and gas development activities on these or other similar bird species. However, one study found that, with the exception of ovenbirds, abundance of 41 species of songbirds, and location and size of their territories, were unaffected by seismic lines in boreal forests of the Northwest Territories (Machtans 2006). Clearing operations to prepare seismic lines, and explosions that occur during seismic surveys, may disturb wildlife. Birds and wildlife are particularly sensitive during nesting and calving periods (Schneider 2002). Repeated disturbances can result in increased movement rates of wildlife and subsequent significant energy losses, which can be particularly problematic during winter when food supplies may be scarce (Schneider 2002). Bald eagles are protected by the Bald Eagle Protection Act and eagles and most native birds are protected under the Migratory Bird Treaty Act. Licensees are advised that their actions may not take bald eagles. The Bald Eagle Protection Act defines “take” to include disturbing birds.

Some limited information is available concerning effects of support facilities. For example, in one study, caribou used habitat near roads less than habitat farther away, ranging from 0% of expected use in closed coniferous wetlands in late winter to about 34% during summer in open coniferous wetlands (Dyer et al. 2001). Caribou also avoided well sites at some distances and seasons, although expected use was greater than 100% for others (Dyer et al. 2001). Cumulative effect of avoidance of all industrial development was a potential loss of 48% of the 617,204 ha study area (Dyer et al. 2001). However, studies of caribou in northern Alaska before and after construction of a road showed no significant differences in densities of caribou near the road (Noel et al. 2004), and pipelines elevated ≥1.5 m were found to not cause changes in caribou use or delay migrations (Noel et al. 2006). In addition, despite concerns that oil and gas development and infrastructure such as roads may displace caribou, sizes of caribou herds in northern Alaskan oilfields have increased from 5,000 to 32,000 animals since oilfield development began, and recent studies indicate that negative effects from displacement are absent or negligible (Noel et al. 2004; Haskell et al. 2006).

The Healy Basin contains areas of critical habitat for Dall sheep (ADNR 1991) and small areas may be in the license area. Due to the fragmented and disjointed nature of Dall sheep habitat, they are particularly susceptible to both habitat loss and disturbance. Potential reactions of sheep to disturbance include escape behavior, reduction in foraging efficiency, interrupted feeding, increased exposure to predators, and higher heart and metabolic rates, all of which may impact reproductive success and population levels (Beckstead 2004). The slower speeds of civilian helicopters and fixed-wing aircraft may enable sheep to locate the source and direction of the disturbance while the aircraft is still distant and may allow sheep to respond less strongly to the stimulus (Beckstead 2004, citing

Dept. of the Air Force 1995). However, aircraft should avoid circling over sheep. Aircraft overfights of lambing areas should be avoided during lambing, approximately May 15 to June 20.

e. Wolf Townships

Some residents and DNPP have expressed concern about caribou and other species in the Wolf Townships (state lands in the notch between DNPP lands). In 1988 NPS proposed that these lands be added to DNPP; however, the Secretary of Interior did not forward the proposal to Congress. Recognizing the area's importance as caribou calving and wintering habitat in TBAP, UCM, in drafting the proposed license area, specifically excluded most of these lands. DNPP maps of caribou sightings in this area show caribou densities are much higher in park lands and, to a lesser extent, on state owned lands further west, adjacent to the license area (DNPP 2005). Mitigation measures imposed on the license and in subsequent plan of operations will protect caribou, other species, habitat, and recreational values. In particular, the director, in consultation with ADF&G, may impose seasonal restrictions on activities located in, or requiring travel through or overflight of, important moose and caribou calving and wintering areas.

i. Well Blowout

Indirect pollutants from burning hydrocarbons, whether intentional or unintentional, would include NO_x, CO, SO_2 and particulate matter (BLM 2005). Nitrate oxides (NO_x) and sulfur dioxides (SO_2) are the primary components of acid deposition from the atmosphere. Depending on the buffering capacity of soils and waters where acids are deposited, the lowered pH levels may be toxic to fish. If a natural gas blowout or fire were to occur, individual animals in the immediate vicinity could be killed or displaced. Blowouts of natural gas condensates that did not burn would disperse very rapidly. It is unlikely that toxic fumes would affect animals except those very near to the source of the blowout. Licensees must prepare an emergency preparedness and response plan which addresses explosions, fires, gas or water pipeline leaks or ruptures, earthquake or flood events, or hazardous material spills.

ii. Spill of a Hazardous Substance

The general effects of an incidental spill of a hazardous substance on terrestrial animals include contamination of individual animals, habitats, and some local food sources. Predators may ingest contaminated prey at a spill site or ingest hazardous substances through grooming.

Potential adverse effects on fish from a spill of a hazardous substance could include lethal concentrations and oiling of the gills causing fish kill, mortality of prey species, mortality from consumption of contaminated prey, and blockage of movement or displacement from important habitats. Mortality of eggs and fry could occur in spawning or nursery areas from the toxic effects of the oil or other substance. Sublethal effects may also reduce fitness and affect the ability to endure environmental stress. Effects of oil spills during the winter are expected to be negligible; effects during the open water season could be more harmful, depending on the site-specific conditions.

Prevention of and responsive countermeasures to any spill of a hazardous substance, even those incidental in nature, are particularly critical to assure protection of birds. The number of birds impacted by a spill would depend on the time of year, the extent of the spill, the amount of aquatic habitat affected, and the density of local bird populations. The direct effect of petroleum on a bird is to clog the fine structure of its feathers, which is responsible for maintaining water-repellence and providing heat insulation. The loss of thermal insulation, especially in cold climates, results in greatly increased metabolic activity to maintain body temperature. Birds also ingest oil in attempting to preen oil from their plumage. Some species, such as bald eagles and golden eagles, may encounter and ingest oil while preying on fish and oil-contaminated carcasses. Relatively small amounts of ingested oil can cause a temporary depression of egg laying and reduce the hatching success of those eggs that are laid. Oil deposited on eggs from the feathers of the adults can also have an adverse

impact on hatching, even in small quantities. The birds most susceptible to oiling are those which are gregarious, spend most of their time on the water, and dive rather than fly up when disturbed (NRC 1983).

Licensees must prepare an emergency preparedness and response plan which addresses explosions, fires, gas or water pipeline leaks or ruptures, earthquake or flood events, or hazardous material spills.

2. Mitigation Measures and Other Regulatory Protections

Although activities subsequent to licensing could potentially have cumulative effects on the region's species and habitats, measures in this best interest finding, along with laws and regulations imposed by other state, federal, and local agencies, are expected to avoid, minimize, and mitigate those potential effects.

Measures imposed on the license and licensee advisories regulate water quality and quantity; restrict the siting of facilities; restrict the disposal of drilling muds and cuttings; avoid habitat loss; protect wetland, riparian, and aquatic habitats; minimize disturbance and the extent of facilities; protect watercourses; minimize conflicts between humans and bears; and prohibit permanent facilities during exploration, among other stipulations. Federal law and an international treaty protect migratory birds and bald eagles. A complete list of mitigation measures and licensee advisories is found in Chapter Nine.

E. Cumulative Effects on Subsistence and Other Uses

1. Potential Effects on Subsistence and Other Uses

Residents of the Healy Basin use portions of the license area for subsistence activities such as hunting, trapping, and fishing. Commercial use focuses on recreational services offered to visitors to Denali National Park and Preserve, such as rafting, dog mushing, and flight seeing. Many independent users recreate in the area as well.

There are no commercial harvests of wildlife resources in the Healy area. Restrictions on sport hunting in the license area are in effect (ADF&G 2008). In GMU 20A, the Ferry Trail Management Area is open to caribou hunting by permit only. The Healy-Lignite Management Area, also in GMU 20A, is open to hunting by bow and arrow only.

Subsistence, sport hunting and fishing, and tourism of the Healy Basin depend on the area's fish, wildlife, and habitats. Therefore, potential cumulative effects from gas exploration, development and production on the area's fish, wildlife, and habitats could also affect subsistence, and sport hunting and fishing, and tourism. Potential cumulative effects to fish, wildlife, and habitats are discussed in the preceding sections.

Siting facilities in popular viewsheds could adversely affect both visitors and local residents. Consequently, measures will be imposed to minimize visual impacts associated with facilities. These include minimizing the size of structures; minimizing damage to vegetation; minimizing the size of work pads; locating facilities away from prominent features, hilltops, and ridges; locating facilities at the base of slopes; painting permanent facilities in uniform, non-contrasting, non-reflective color tones slightly darker than the adjacent landscape; directing exterior lighting, when required, away from residential areas, or effectively shielding the light from such areas; and landscaping permanent facilities. Other measures related to water quality, siting of facilities, minimizing noise, and maintaining fish and wildlife populations and habitat will help maintain the area's attraction to visitors.

Many factors affect subsistence, and sport hunting and fishing activities, including the availability of fish and wildlife populations, weather, methods of harvest, availability of transportation, state and federal hunting and fishing regulations, local economic conditions, and skill, determination and

resources of the individual. All of the communities surrounding the license area rely on subsistence harvests as an important source of food.

Reductions in local fish and wildlife populations could result in increased travel distance and hunting time required to harvest resources, potential reductions in harvest success rates, and increased competition for nearby subsistence resources. However, development of roads in support of gas development could improve access to the area for local hunters and fishers, which could result in higher success rates. Improved transportation infrastructure and increased air service to the area could result in increased availability of hunting, fishing and other subsistence supplies and equipment, and could lower their cost, making subsistence use more frequent for local residents. Increased employment opportunities could also allow local residents to more readily purchase supplies and equipment for hunting and fishing activities, which could also increase hunting and fishing opportunities and success.

Although gas activities subsequent to licensing could potentially have cumulative effects on subsistence and sport hunting and fishing, measures in this finding, along with regulations imposed by other state and federal agencies, are expected to avoid, minimize, and mitigate those potential effects. Mitigation measures included in this finding that will directly protect subsistence and other uses address siting of facilities and pipelines, avoidance of conflicts between subsistence uses and gas activities, access to subsistence areas, and training. Most of the other measures protect subsistence and other uses indirectly by protecting the fish and wildlife populations and habitats on which they harvests rely. A complete list of mitigation measures and licensee advisories is found in Chapter Seven.

2. Mitigation Measures and Other Regulatory Protections

Although gas activities subsequent to licensing could potentially affect subsistence, sport, and recreational uses, primarily as secondary effects from effects on habitat, fish, or wildlife, measures in this best interest finding, along with regulations imposed by other state, federal and local agencies, are expected to avoid, minimize, and mitigate those potential effects. A complete list of mitigation measures and licensee advisories is found in Chapter Nine.

F. Effects on Historic and Cultural Resources

1. Potential Effects on Historic and Cultural Resources

Potential impacts on historic and cultural resources could occur in the exploration, development, or production phases, but are more likely if development occurs. Impacts could include disturbance of historic and archeological sites. Impacts could be associated with installation and operation of gas facilities, including drill pads, roads, airstrips, pipelines, processing facilities, and any other ground-disturbing activities. Damage to archaeological sites could include direct breakage of cultural objects; damage to vegetation and thermal regime, leading to erosion and deterioration of organic sites; shifting or mixing of components in sites resulting in loss of association between objects; and damage or destruction of archeological or historic sites by crews collecting artifacts (USFWS 1986).

To prevent damage and ensure preservation, an inventory of prehistoric, historic, and archeological sites must be conducted prior to the construction or placement of any structure, road, or facility. The inventory must include consideration of literature provided by local residents; documentation of oral history regarding prehistoric and historic uses of such sites; evidence of consultation with the Alaska Heritage Resources Survey and the National Register of Historic Places; and site surveys. If any resources could be affected by license activities, the director, after consulting with the State Historic Preservation Officer (SHPO), will direct the licensee's course of action to protect the site. In the event that any site, structure, or object of prehistoric, historic, or archaeological significance is discovered during operations, the licensee must immediately report such findings to the director. The

licensee must make reasonable efforts to preserve and protect the discovery from damage until the director consults with the SHPO and directs the course of action to avoid or minimize adverse effects.

Additionally, state laws prohibit the destruction or removal of historic and cultural resources (AS 41.35.010-41.35.240). Violators are subject to criminal (misdemeanor) penalties and civil penalties, including fines up to $100,000.

Site-specific and project-specific mitigation measures may be imposed as necessary if exploration and development take place. Licensees are required to conduct training for all employees and contractors on environmental, social, and cultural concerns in the area of activity.

2. Mitigation Measures and Other Regulatory Protections

Cumulative effects on historical and archaeological sites from natural gas exploration, development, and production activities are expected to be low. In the event that an increased amount of ground-disturbing activity takes place, mitigation measures imposed on the licensee and state and federal laws and regulations should mitigate effects to archaeological resources.

These measures, laws, and regulations will help insure these resources are protected and preserved. Mitigation measures address education and protection of historic and archeological sites. A complete list of mitigation measures and licensee advisories is found in Chapter Nine.

G. Fiscal Effects on the State, Municipalities, and Communities

1. Potential Fiscal Effects on the State

Alaska's economy depends heavily on revenues related to oil and gas production and government spending resulting from those revenues. The primary source of state revenues is North Slope oil production. In FY 2008, oil and gas revenues totaled $9.956 million and comprised approximately 93% of the state's general fund unrestricted revenue. However, oil and gas reserves are finite resources and North Slope and Cook Inlet production are declining. The forecast for FY 2009 sets unrestricted oil revenue at $5.1 billion and the forecast for FY 2010 sets it at $2.6 billion (ADOR 2009). Alaska North Slope production peaked at 2.006 million barrels per day in FY 1988 and has declined steadily since then, producing 0.717 million bbls per day in FY 2008 (ADOR 2009). The Alaska Department of Revenue (ADOR) anticipates volumes will decline by 3.8% in FY 2009 to about 0.689 million barrels per day, declining further to 0.665 million barrels per day in FY 2010. Cook Inlet oil fields produced 0.014 million bbls per day in FY 2008 and have an FY 2009 projection of .013 million bbls per day. Regardless of the price of crude oil and natural gas, general fund receipts will probably continue to decline.

Issuing the exploration license will result in a onetime increase in state income from the $1 per acre licensing fee. At 208,630 acres this license will result in a fee of $208,630.

Gas only licenses generate income for state government through license fees. If converted to a lease, a gas lease generates income to state government through royalties (including rents and interest), production taxes, petroleum corporate income taxes, and petroleum property taxes. Income from the license and subsequent lease is expected to make a small contribution to the state's petroleum revenues.

The holder of the license pays a onetime $1 per acre ***license fee***. The state has issued six exploration licenses for a total of 1,739,068 acres; recent licenses are Copper River Basin (expired), Nenana Basin (extended), Susitna Basin I (terminated), and Susitna Basin II. License fees, therefore, have totaled $1,739,068. At 208,630 acres, the Healy license would result in a fee of $208,630.

Once the work commitment has been met, a portion of the license area may be converted to gas leases (Appendix D). While no rentals are due for a license, each lease requires an annual ***rental payment***. The term of the leases will likely be for 10 years. The first year's rent is $1 per acre or fraction of an acre, and the rent increases in 50-cent increments to $3 per acre or fraction of an acre in the fifth and all subsequent years of the lease. The lessee must pay the rent in advance. The lessee receives a credit on the royalty due for that year equal to the rental amount.

Royalties represent the state's share of the production as the mineral interest owner. Royalty is paid based on the agreed value of the oil or gas removed from the lease, the volume removed and the lease's royalty rate. The royalty rate can vary from 5% to 60% based on the terms of the lease, but is most often 12.5%. The royalty for gas only leases subsequent to this license is 12.5%. Given the probability of conventional and coal bed shallow natural gas in the Healy area, the state could realize revenue income from royalties, the amount of which is dependent on production levels.

Under AS 38.05.180(n)(2), if the lessee under a gas-only lease demonstrates to the commissioner that the potential resources underlying the lease are reasonably estimated to be nonconventional gas (eg., coalbed methane), the rental payment is $1.00 per acre and if the nonconventional gas produced will not be in direct competition with gas on which a royalty at a rate of at least 12.5% is payable, then the royalty share payable to the state on all production of gas from the pool attributable to that lease shall be 6.25%. The state also allows for royalty reduction under certain other circumstances. These reductions are explained in AS 38.05.180(f)(5) and AS 38.05.180(j).

Production taxes are the biggest source of state revenue. In 2007, the state replaced the Petroleum Profits Tax (PPT) with the Alaska's Clear and Equitable Share (ACES). The revision increased overall rates and narrowed allowances for cost deductions and investment credits. With the new law, oil and gas revenue estimates are significantly higher than would have been expected under the prior law. For FY 2008 production taxes were $6.879 billion; for FY 2009 they are forecast to be $3.579 billion (ADOR 2008).

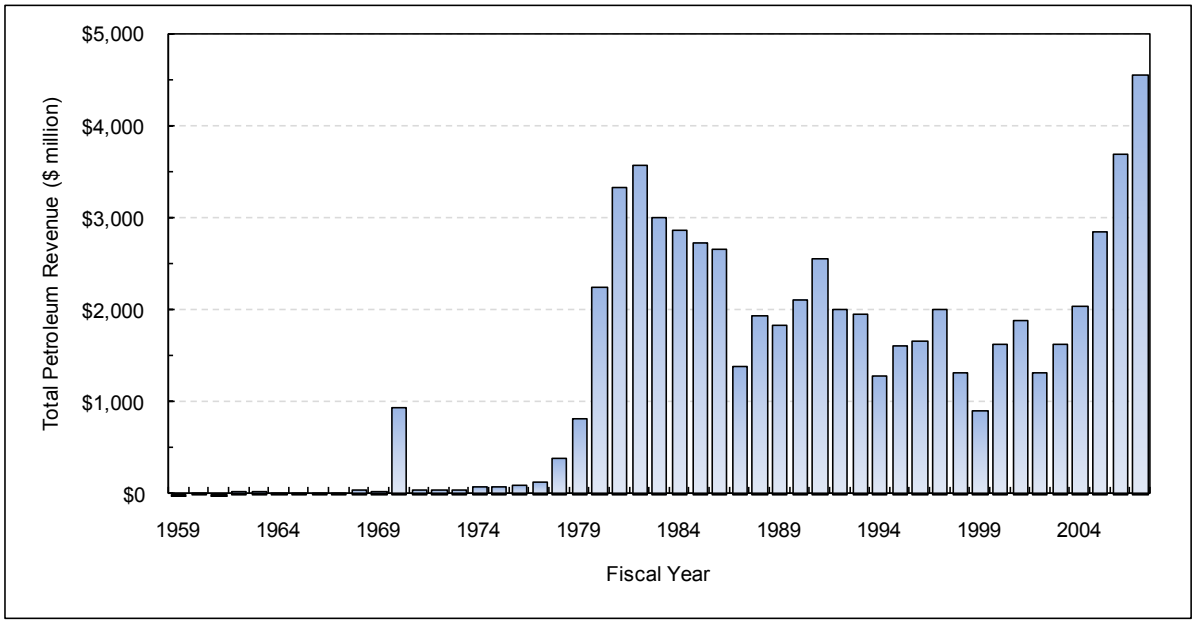
All corporations in the state must pay ***corporate income tax*** for all taxable income derived from sources within the state. Most, if not all, producers and transporters of oil and gas in Alaska are corporations.

A ***petroleum property tax*** is levied each year on the full and true value of property taxable under AS 43.56. This includes exploration property, production property, and pipeline transportation property.

The potential for additional revenue from rents, royalties, and taxes is unpredictable because it is unknown if reserves will be found. There is a high potential for shallow natural gas within the coal beds in the license area. However, it is unknown whether the quantity of gas, if any is discovered, will support a commercial project.

Oil and gas revenues fund education and the operating and capital budgets. State spending supports nearly one-third of jobs in Alaska, and about 30% of personal income results from state spending. Nearly half of local government jobs (including school district jobs) in Alaska rely on state funding (Goldsmith 1991). Oil and gas revenues also contribute to the Alaska Permanent Fund, which pays dividends each year to eligible state residents.

Given the estimated high potential for shallow coalbed gas in the Healy area, it is possible that this project will contribute to these state revenues. The level of that contribution, however, is unknown and depends on success at every project phase, and ultimately on levels of gas production. In comparison to the state's total revenue from oil and gas activities, the anticipated revenue from the Healy Exploration License is unlikely to cause a significant percentage increase.



Source: ADOR 2007.

Notes: Includes petroleum corporate income tax; production tax; petroleum property tax; oil and gas royalties (net); bonuses, rents and interest (net); and petroleum special settlements. Does not include Permanent Fund contributions and Constitutional Budget Reserve Fund.

Figure 8.1. Historical petroleum revenue to the State of Alaska, 1959-2007.

Natural gas production in the Cook Inlet is expected to continue diminishing, barring significant new discoveries. The potential availability of natural gas on the road system could have a positive impact beyond the value of royalty income to the state.

While production of natural gas resources from coal have yet to be fully developed, the potential of coalbed methane as a significant source of clean-burning natural gas in Alaska is promising.

2. Fiscal Effects on Local Communities

The Healy area's economic structure consists of communities with seasonal economies, with employment peaking during the summer months. The fiscal effects of licensing are largely related to potential job creation; this is discussed in the next section.

Oil and gas property is exempt from local municipal taxation, but the state levies a 20-mill tax against this property. Each municipality or borough with oil and gas property within its boundaries is reimbursed an amount equal to the taxes which would have been levied on the oil and gas property, up to the 20-mill limit. The Denali Borough does not tax property owners.

As noted above, oil and gas revenues fund education, including schools in the Denali Borough. Table 8.1 shows state funding and enrollment figures for the Denali School District. Revenues from development of gas resources in the Healy Basin, though modest in comparison to oil and gas revenues from the North Slope or Cook Inlet, will contribute to the state's support of schools and other programs.

Fiscal effects are anticipated to be positive, therefore no mitigation measures were developed for this topic.

Table 8.1. State aid and enrollment for the Denali Borough School District, FY 2000-2008.

Fiscal Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Aid in millions	$2.7	$2.6	$2.5	$2.6	$3.7	$4.5	$4.5	$4.3	$4.3
Enrollment	326	313	288	310	571	664	634	548	574

Source: ADEED 2009a, b.

H. Effects of Gas on the Denali Borough and Communities

1. Potential Effects on the Denali Borough and Communities

An exploration license may create a small number of new employment opportunities in the gas, service, transportation, utilities, and retail sectors of the local economy. Short-term job opportunities could arise during the exploration phase. The long-term employment benefits of the issuance of a license in the Healy Basin area will depend on the subsequent production of commercial quantities of gas. Employment effects could be both short and long term.

The number of jobs produced will depend on whether commercial quantities of gas are discovered, and whether projects to develop those resources are pursued. Industry investment in environmental and wildlife studies, planning and design activities, materials acquisition, facility construction, seismic surveys, drilling, transportation, and logistics contribute positively to both the state and local economies.

Local communities may provide some labor needs if projects are proposed, approved, and developed within a reasonable commuting distance. Locally owned and operated companies may also provide services to the licensee or operators and may hire additional staff to meet the increased workload. Local contracts for resources and services, such as gravel and road construction, might also contribute to the local economy.

The number of nonresident workers employed in Alaska provides an indicator of labor shortage in the state. Although this deficit of workers may be the result of a variety of factors, including relatively low pay or highly seasonal work that does not promote long term residency, many high paying year-round jobs go to nonresidents. The percentage of total private sector workers who are residents of the Denali Borough was 18.6% in 2006, compared to 73.3% in the Municipality of Anchorage and 72.8% in Fairbanks North Star Borough (ADOL 2008).

The local labor force may not be able to meet demands for some technical positions. As a result, these jobs may be filled by workers from the service support industry that is active in other regions of the state, or outside Alaska. However, licensees and their contractors are encouraged to hire local and Alaska residents to the extent they are qualified and available. Plans of operation must include a proposal detailing the means by which the licensee will comply with this measure.

Local businesses, such as charter operators, heavy equipment operators, welders, plumbers and pipe fitters, carpenters, vendors, food service providers, and air carriers could provide support for gas activities. Competition for available labor would be highest in the transportation, retail, wholesale, and service sectors of the regional economy during the summer months when tourism, sport fishing, and commercial fishing industries are most active and employing workers for the season. Construction activities could occur during both summer and winter months.

If natural gas is found, residents may gain access to natural gas, a lower cost alternative to fuel oil and electricity for heating. Local utilities may be able to generate electricity from natural gas, which is more efficient, less expensive, and less polluting than diesel or coal.

Local residents' use of the area requires access to it; any activity, facility, or structure that restricts access can have an adverse impact on local residents. However, blocking access and use is not allowed except in the immediate vicinity of drill sites, buildings, and other related facilities. Other effects include disturbance due to increased air traffic, drilling and construction machinery noise, and loss of privacy due to the presence of project workers. The extent of these effects depends on the size of exploration and development projects and the proximity of facilities, and utility, pipeline, and transportation corridors to the affected community. Most disturbance effects would be temporary, limited to the construction and exploration timeframes.

New exploration and development activities will require labor and may require capital-intensive infrastructure. The presence of workers could increase the demand for some public services, like housing or sanitation. New exploration and development projects undertaken in areas away from existing infrastructure may have to be self-sufficient. If located near existing communities, such activities may place additional burdens on nearby community facilities. Since the existence or location of any discoveries are unknown, it is not possible to predict the impact on community services at the license phase.

Some gas projects may require a source of power. A licensee may use natural gas produced at the wellhead to power equipment or may utilize electricity from the local utility. The suitability of an existing community utility would depend on the specific project proposed, its location, and the existing supply and demand for the service. It would also depend on the ownership structure of the utility and whether the facility had the capacity to accommodate industrial demand.

Proximity to existing transportation, storage, and processing facilities is a major consideration in petroleum development planning, especially if a discovered field is considered marginally economic. Logistical constraints and environmental parameters also affect decisions on locating post-exploration phase operations. Field development would take place relatively close to discoveries, and facilities would likely be sited near wells. Exploration and development activities, including construction, probably would not be readily visible outside of the area.

Communities closest to exploration activities may experience increased use of transportation systems, such as air charter services, airstrips, or roads for movement of personnel or construction equipment. Some portions of the area could be developed from existing roads or access routes; however, much of the acreage is remote from existing infrastructure. Larger reserves are required to justify the additional expense of providing transportation to remote sites.

Development of the area could adversely affect human uses of the area and its biological resources if access to hunting, fishing, or trapping areas were restricted or if industry activities occurred at the same place and time as these activities. To avoid this conflict, use of the area by local residents will be unrestricted, except when required within the immediate vicinity of drill sites, buildings, and other related facilities. Areas of restricted access must be identified in the plan of operations.

It is also possible that a proposed activity, such as the building of permanent roads after the license is converted to a lease, could allow for easier access to property within or near the license area. The increase in human presence on these lands could have negative impacts on subsistence and recreational use. Conversely, development of the area could increase access for users of the area's resources. If roads were constructed across general state lands, they would be open to the public and available for multiple use activities. If development occurs, consolidation of petroleum facilities is intended to reduce conflicts with recreational uses of the area. A plan of operations must include an analysis of road and access issues associated with site development. All aspects of transportation

related to the proposed activity and possible effects on existing uses, and implementation of mitigation measures, must be considered.

2. Mitigation Measures and Other Regulatory Protections

If unregulated, activities subsequent to licensing (and leasing) could potentially have cumulative effects on the Denali Borough and local communities. However, measures in this best interest finding, along with laws and regulations imposed by other state, federal, and local agencies, are expected to avoid, minimize, and mitigate any potential adverse effects.

Measures imposed on the license and licensee advisories regulate water quality and quantity; restrict the siting of facilities; restrict the disposal of drilling muds and cuttings; avoid habitat loss; protect wetland, riparian, and aquatic habitats; minimize disturbance and the extent of facilities; protect watercourses; minimize conflicts between humans and bears; and prohibit permanent facilities during exploration, among other stipulations. Each of these and other measures are designed to protect the license area's resources, habitats, and uses and, in turn, protect the borough and local communities. A complete listing of mitigation measures is found in Chapter Nine.

I. Effects on Denali National Park and Preserve

1. Potential Effects on Denali National Park and Preserve

Denali National Park and Preserve is a major tourist attraction which borders a portion of the license area (Figure 1.1). At 6 million acres, the park and preserve is larger than the state of New Hampshire. Visitors to the park numbered 458,308 in 2007. No exploration or production activities will take place within the park but there are concerns that activities in the license area could impact air and water quality as well as wildlife that use both the park and license area. Effects on Denali National Park and Preserve are expected to be minor, given the relatively small size of the license area (208,630 acres) relative to the size of the park and preserve.

2. Mitigation Measures and Other Regulatory Protections

Mitigation measures and licensee advisories, combined with federal, state, and local laws and regulations, are designed to directly protect the license area. These requirements, in turn, directly and indirectly protect Denali National Park and Preserve. Refer to the previous sections in this chapter for summaries of mitigation measures designed to avoid, minimize, or mitigate impacts on water quality, air quality, viewshed, habitat, fish, birds, and wildlife. For a complete listing of mitigation measures and licensee advisories, see Chapter Nine. Other laws and regulations are discussed in Chapter Seven and Appendix B.

J. References

ADCED (Alaska Department of Community and Economic Development)

2009 Community Online Database. Alaska Department of Community and Economic Development. http://www.dced.state/ak.us/dca/commdb/CF_combdb.htm Accessed 1/2005 & 4/2009.

ADEC (Alaska Department of Environmental Conservation)

2008 Division of Air Quality information. http://www.dec.state.ak.us/air/ Accessed July 22, 2008.

ADEED (Alaska Department of Education and Early Development)

2009a Enrollment totals as of October 1 of each year (2000-2008). Statistics & Reports. http://www.eed.state.ak.us/stats/ Accessed February 10, 2009.

ADEED (Alaska Department of Education and Early Development)
2009b State aid to each district FY88-FY08. Statistics & Reports. http://www.eed.state.ak.us/stats/QuickFacts/STATEAID.pdf Accessed February 10, 2009.

ADF&G (Alaska Department of Fish and Game)
1994 Loons. ADF&G Wildlife Notebook Series. Alaska Department of Fish and Game. http://www.adfg.state.ak.us/pubs/notebook/bird/loons.php Accessed May 16, 2008.

ADF&G (Alaska Department of Fish and Game)
2003 Eagles. ADF&G Wildlife Notebook Series. Alaska Department of Fish and Game. http://www.adfg.state.ak.us/pubs/notebook/bird/eagles.php Accessed May 15, 2008.

ADF&G (Alaska Department of Fish and Game)
2006 Our wealth maintained: A strategy for conserving Alaska's diverse wildlife and fish resources. Alaska Department of Fish and Game, Juneau. http://www.sf.adfg.state.ak.us/statewide/ngplan/NG_outline.cfm

ADF&G (Alaska Department of Fish and Game)
2007 Personal communication from Mark Fink, Habitat Biologist, Division of Sport Fish, Anchorage to Allison Iverson, DO&G. June 6, 2007.

ADF&G (Alaska Department of Fish and Game)
2008 Division of Wildlife Conservation game management units maps online. http://www.wildlife.alaska.gov/gis/index.cfm?GIS=GMU.RegBookMaps Accessed March 4, 2008.

ADGC (Alaska Division of Governmental Coordination)
1995 Classification of state agency approvals: ABC list, volumes I and II. State of Alaska, Office of the Governor, Division of Governmental Coordination. May 1995.

ADNR (Alaska Department of Natural Resources)
1991 Tanana Basin Area Plan for State Lands. ADNR, Fairbanks, AK.

ADOL (Alaska Department of Labor and Workforce Development)
2008 Nonresidents working in Alaska 2006. Alaska Department of Labor and Workforce Development. January 2008. http://146.63.75.50/research/reshire/nonres.pdf

ADOR (Alaska Department of Revenue)
2007 Revenue Sources Book: Fall 2007 forecast and historical data. Prepared by the Alaska Department of Revenue, Tax Division. http://www.tax.alaska.gov/programs/documentviewer/viewer.aspx?1202f

ADOR (Alaska Department of Revenue)
2008 Revenue sources book: Fall 2008. Prepared by the Alaska Department of Revenue, Tax Division. http://www.tax.alaska.gov/programs/documentviewer/viewer.aspx?1531f

ADOR (Alaska Department of Revenue)
2009 February 2009 interim FY 2010 revenue forecast. Tax Division. http://www.gov.state.ak.us/omb/10_omb/budget/10%20PDFs/Feb09_Interim_Forecast_FY10_2-18-09.pdf

AOGCC (Alaska Oil and Gas Conservation Commission)
2004 2004 annual report. Gas disposition. February 17, 2006 update. http://www.aogcc.alaska.gov/annual/2004/2004_Gas_Disposition_Final.pdf

Beckstead, D.
2004 The effects of military jet overflights on Dall's sheep in Interior Alaska. http://www.arlis.org/docs/vol1/58732389/index.html

BLM (Minerals Management Service)
2004 Alpine satellite development plan, final environmental impact statement. NPR-A Planning. September 2004. http://www.blm.gov/ak/st/en/prog/planning/npra_general/alpine_plan/alpine_feis.html

BLM (Bureau of Land Management)
2005 Northeast National Petroleum Reserve - Alaska. Final amended integrated activity plan/environmental impact statement. Volume I. January 2005. http://www.blm.gov/ak/st/en/prog/planning/npra_general/ne_npra/ne_npra_feis.html

BLM (Bureau of Land Management)
2008 Northeast National Petroleum Reserve - Alaska final supplemental integrated activity plan/environmental impact statement. Volume I: Abstract, executive summary, chapters 1-3. May 2008. http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/energy/npra_planning.Par.1035.File.dat/NE_May_2008_supp_npra_final_vol_1.pdf

CBM
2004 CBM primer. Energy Processing Canada. http://findarticles.com/p/articles/mi_qa5406/is_200409/ai_n21362602/?tag=content;col1 Accessed

CFWE
2007 Ripple Effects - Colorado's New Energy Economy. http://cfwe.org/headwaters/headwaters.asp Accessed

CNGA
2009 Coalbed Natural Gas Alliance. cbnga.com/cbngillustrations.htm Accessed 2/26/09.

DNPP (Denali National Park and Preserve)
2005 Personal communication from Paul Anderson, Superintendent to Jonne Slemons, DO&G. October 31.

Dyer, S. J., J. P. O'Neill, S. M. Wasel and S. Boutin
2001 Avoidance of industrial development by woodland caribou. Journal of Wildlife Management 65(3):531-542.

EPA (Environmental Protection Agency)
1995 Notice of proposed reissuance of a National Pollutant Discharge Elimination System (NPDES) permit to discharge to waters of the United States, notice of state certification, and notice of state determination of consistency with the Alaska Coastal Management Program. Public Notice #AKG285100 U.S. Environmental Protection Agency, Cook Inlet (Reissuance). September 20, 1995.

EPA (Environmental Protection Agency)
2004a Evaluation of impacts to underground sources of drinking water by hydraulic fracturing of coalbed methane reservoirs, final. Office of Ground Water and Drinking Water Protection. EPA 816-R-04-003. http://www.epa.gov/OGWDW/uic/wells_coalbedmethanestudy.html

EPA (Environmental Protection Agency)
2004b Federal regulatory programs for coal bed methane activities in Alaska. EPA Region 10. http://www.cookinletoilandgas.org/Shallow%20Coal%20Bed%20Methane/Federal/Coal%20Bed%20Methane%20Fact%20Sheet.pdf

EPA (Environmental Protection Agency)
2007 The plain English guide to the Clean Air Act. Office of Air Quality Planning and Standards, Publication No. EPA-456/K-07-001. http://www.epa.gov/air/caa/peg/

EPA (Environmental Protection Agency)
2008a National Emission Standards for Hazardous Air Pollutants (NESHAP). Technology Transfer Network, Air Toxics Website. http://www.epa.gov/ttn/atw/mactfnlalph.html Accessed August 25, 2008.

EPA (Environmental Protection Agency)
2008b NPDES permit program basics: Frequently asked questions. National Pollutant Discharge Elimination System. http://cfpub1.epa.gov/npdes/faqs.cfm?program_id=45#119 Accessed April 23, 2008.

Goldsmith, S.
1991 Alaska's dependence on state spending. ISER Fiscal Policy Papers No. 5. Institute of Social and Economic Research, Univeristy of Alaska Anchorage. April 1991. http://www.iser.uaa.alaska.edu/publications/formal/fppapers/fpp5.pdf

Graves, T. A., S. Farley and C. Servheen
2006 Frequency and distribution of highway crossings by Kenai Peninsula brown bears. Wildlife Society Bulletin 34(3):800-808. http://www.wildlifejournals.org/archive/0091-7648/34/3/pdf/i0091-7648-34-3-800.pdf

Guyer, S. and B. Keating
2005 The impact of ice roads and ice pads on tundra ecosystems, National Petroleum Reserve-Alaska. U.S. Department of the Interior, Bureau of Land Management, BLM-Alaska Open File Report 98. http://www.blm.gov/pgdata/etc/medialib/blm/ak/aktest/ofr.Par.59140.File.dat/OFR%2098.pdf

Haskell, S. P., R. M. Nielson, W. B. Ballard, M. A. Cronin and T. L. McDonald
2006 Dynamic responses of calving caribou to oilfields in northern Alaska. Arctic 59(2):179-190.

Henley, W. F., M. A. Patterson, R. J. Neves and A. D. Lemly
2000 Effects of sedimentation and turbidity on lotic food webs: a concise review for natural resource managers. Reviews in Fisheries Science 8(2):125-139. http://www.dnr.state.ak.us/acmp/Science/documents/Water-Streams-Soils/EffectsofSedimentationandTurbidity.pdf

Huntington, H. P.
2007 Arctic oil and gas 2007. Arctic Monitoring and Assessment Programme. http://www.amap.no/oga/

James, A. R. C.
1999 Effects of industrial development on the predator-prey relationship between wolves and caribou in northeastern Alberta. Doctoral dissertation, University of Alberta, Edmonton, Alberta.

Linkins, A. E., L. A. Johnson, K. R. Everett and R. M. Atlas
1984 Oil spills: Damage and recovery in tundra and taiga. Pages 135-155 *in* J. Carins, Jr. and A. L. Buikema, Jr., editor. Restoration of habitats impacted by oil spills. Butterworth Publishers, Boston.

MacFarlane, A. K.
2003 Vegetation response to seismic lines: edge effects and on-line succession. Master's thesis, University of Alberta, Edmonton, Alberta.

Machtans, C. T.
2006 Songbird response to seismic lines in the western boreal forest: a manipulative experiment. Canadian Journal of Zoology 84:1421-1430.

McLean, R. F.
2004 Holitna Basin exploration license area comments. Alaska Department of Natural Resources, Office of Habitat Management and Permitting, Anchorage, Alaska.

McLellan, B. N. and D. M. Shackleton
1988 Grizzly bears and resource-extraction industries: effects of roads on behaviour, habitat use and demography. Journal of Applied Ecology 25:451-460.

MMS (Minerals Management Service)
2003 Beaufort Sea planning area sales 186, 195, and 202 oil and gas lease sale final EIS. OCS EIS/EA MMS 2003-001, Alaska OCS Region. http://www.mms.gov/alaska/ref/EIS%20EA/BeaufortMultiSaleFEIS186_195_202/maps.pdf

MMS (Minerals Management Service)
2008 Beaufort Sea and Chukchi Sea planning areas, oil and gas lease sales 209, 212, 217, and 221 draft EIS. Alaska OCS Region. http://www.mms.gov/alaska/ref/EIS%20EA/ArcticMultiSale_209/_DEIS.htm

NETL (National Energy Technology Laboratory)
2009 Future Supply and Emerging Resources, Coal Bed Natural gas. NETL - The Energy Lab. http://www.netl.doe.gov/technologies/oil-gas/FutureSupply/CoalBedNG/CoalBed_NG.html Accessed 6/8/2009.

Noel, L. E., M. K. Butcher, M. A. Cronin and B. Streever
2006 Assessment of effects of an oil pipeline on caribou, *Rangifer tarandus granti*, use of riparian habitat in arctic Alaska, 2001-2003. Canadian Field-Naturalist 120(3):325-330.

Noel, L. E., K. R. Parker and M. A. Cronin

2004 Caribou distribution near an oilfield road on Alaska's North Slope, 1978-2001. Wildlife Society Bulletin 32(3):757-771.

NRC (National Research Council)
1983 Drilling discharges in the marine environment. National Research Council (U.S.) Panel on Assessment of Fates and Effects of Drilling Fluids and Cuttings on the Marine Environment, The National Academics Press, Washington, DC.

NRC (National Research Council)
2003 Cumulative environmental effects of oil and gas activities on Alaska's North Slope. The National Academics Press, Washington, DC.

Schneider, R. R.
2002 Alternative futures: Alberta's boreal forest at the crossroads. The Federation of Alberta Naturalists and The Alberta Centre for Boreal Research, Edmonton, Alberta.

Suring, L. H. and G. Del Frate
2002 Spatial analysis of locations of brown bears killed in defense of life or property on the Kenai Peninsula, Alaska, USA. Ursus 13:237-245. http://www.ursusjournal.com/volumes/24SURING.PDF

USFWS (U.S. Fish and Wildlife Service)
1986 Final report baseline study of the fish wildlife, and their habitats, section 1002C, Alaska National Interest Lands Conservation Act.

USGS (U.S. Geological Survey)
2000 Coal-bed methane: Potential and concerns. USGS Fact Sheet, FS-123-00. October 2000. http://pubs.usgs.gov/fs/fs123-00/fs123-00.pdf

USGS (U.S. Geological Survey)
2008 The effects of urbanization on water quality: erosion and sedimentation. http://ga.water.usgs.gov/edu/urbansed.html Accessed August 14, 2008.

Veil, J. A., C. J. Burke and D. O. Moses
1996 Synthetic-based muds can improve drilling efficiency without polluting. Oil and Gas Journal. Volume 94, Issue 10. March 4, 1996.

Wojtanowicz, A. K.
2008 Environmental control of drilling fluids and produced water. Pages 77-122 *in* Stefan T. Orszulik, editor. Environmental technology in the oil industry 2nd Edition. Springer, Dordrecht.

Chapter Nine: Mitigation Measures and Licensee Advisories

Table of Contents

Chapter Nine: Mitigation Measures and Licensee Advisories

AS 38.05.035(e) and the departmental delegation of authority provide the director, Division of Oil and Gas (DO&G) ("director"), with the authority to impose conditions or limitations, in addition to those imposed by statute, to ensure that a resource disposal is in the state's best interests. Consequently, to mitigate the potential adverse social and environmental effects of specific license-related activities, DO&G has developed mitigation measures and will condition plans of operation, exploration, or development and other permits based on these mitigation measures. Should the licensee convert all or a part of the license area into gas leases, these measures will apply to lease-related activities.

These measures were developed after considering terms imposed on earlier licenses and competitive lease sales, as well as comments and information submitted by the public, local governments, environmental organizations, and federal, state, and local agencies. Additional measures will likely be imposed when licensees submit a proposed plan of operations.

The licensee, UCM, must obtain approval of a detailed plan of operations from the director before conducting exploration activities; if all or a portion of the license is converted to a lease, the lessee must also obtain approval of a detailed plan of operations before conducting further exploration, development, or production activities. A plan of operations must identify the sites for planned activities and the specific measures, design criteria, construction methods, and operational standards to be employed to comply with the restrictions listed below. It must also address any potential geophysical hazards that may exist at the site.

Licensees must comply with all applicable local, state, and federal laws, and regulations, as amended, as well as all current or future ADNR area plans and recreation rivers plans, and ADF&G game refuge plans, critical habitat area plans, and sanctuary area plans that contain any portion of the licensed area.

The director may grant exceptions to these mitigation measures. Exceptions will only be granted upon a showing by the licensee that compliance with the mitigation measure is not practicable or that the licensee will undertake an equal or better alternative to satisfy the intent of the mitigation measure. Requests and justifications for exceptions must be included in the plan of operations. Decisions of whether to grant exceptions are made during the public review of the plan of operations.

Except as indicated, mitigation measures do not apply to geophysical exploration on state lands; geophysical exploration activities are governed by 11 AAC 96. Restrictions on geophysical exploration permits will depend on the size, scope, duration, and intensity of the proposed project and on the reasonably foreseeable effects on important species.

Agency abbreviations used in mitigation measures and licensee advisories are:

Abbreviation	Agency Name	Abbreviation	Agency Name
ADF&G	Alaska Department of Fish and Game	DO&G	Division of Oil and Gas (ADNR)
ADEC	Alaska Department of Environmental Conservation	DPOR	Division of Parks and Recreation
ADNR	Alaska Department of Natural Resources	USACOE	U.S. Army Corps of Engineers
DMLW	Division of Mining, Land, and Water (ADNR)	USFWS	U.S. Fish and Wildlife Service

A. Mitigation Measures

1. Facilities and Operations

a. A plan of operations must describe the licensee's plans to minimize impacts on residential, commercial, and recreational areas. At the time of application, licensees must submit a copy of the proposed plan of operations to all surface owners whose property will be entered, and to all owners of surface lands within ½-mile of the proposed work site who can be reasonably identified and located based on records at the state Recorder's office and the borough tax records. A plan of operations application must include several elements, in addition to those required per regulation, as described below:

   i. Identification of any geophysical hazards in the area of operations, and related siting, design, and construction measures for minimizing damage and promoting safety.

   ii. Analysis of road and access issues associated with site development, including, at a minimum:

   - The adequacy of existing access to the site;
   - Route plans for heavy equipment and trucks to avoid rural residences and other sensitive areas to the greatest extent possible;
   - Whether dust control measures are necessary. In such instances, the use of non-toxic dust control measures will be used;
   - The estimated number of site visits by vehicle;
   - Measures to minimize damage to the surface for approved off-road access, including limiting use during inclement weather and wet ground conditions;
   - Measures to minimize the need for new road development, and to ensure that construction of new roads minimizes surface impacts by following existing grades, minimizing cuts and fills, and minimizing habitat fragmentation;
   - Measures to allow for access by emergency response personnel; and,
   - Consideration of public access granted under RS 2477 and other established rights-of-way.

   iii. Measures to control soil erosion and sedimentation during all activities associated with exploration and development.

   iv. An emergency preparedness and response plan which addresses explosions, fires, gas, or water pipeline leaks or ruptures, earthquake or flood events, or hazardous material spills. The plan must include, at a minimum:

   - Contact names and phone numbers of at least two persons responsible for emergency field operations;
   - Plans for annual or periodic training/drills for response personnel;
   - Annual review for necessary updates;
   - A copy of the plan will be provided to the area's emergency responders.

   v. A monitoring plan will be tailored to the specific situation and potential impacts of proposed activities. In approving a monitoring plan, ADNR will consider the following factors:

   - Whether the activities are for exploration or development;
   - Potential impacts to water quality and quantity;
   - Potential noise or visual impacts;
   - Magnitude of proposed ground disturbance;
   - Proximity to sensitive habitats or use areas; and,
   - Potential impact to fish or wildlife populations.

vi. Identification of the components in any hydraulic fracturing materials to be used, the volume and depths at which such materials are expected to be used, and the volume capacity of the vessels to be used to store such materials. No diesel-based fracturing materials may be used.

vii. If surface disposal of produced water is proposed, a water management plan providing detailed information on the location, amounts, and potential impacts associated with the disposal is required. Surface disposal of produced water will not be allowed unless ADEC determines that the discharge will meet state water quality standards and the director has approved the water management plan.

b. Facilities must be designed and operated to minimize sight and sound impacts in areas of residential, commercial, recreational, and subsistence uses; Native allotments; and important wildlife habitat. Methods may include providing natural buffers and screening to conceal facilities, sound insulation of facilities, or by using alternative means approved by the director, in consultation with ADF&G. Operators must meet the following standards for specific activities:

i. The operator will construct drill pads at least 500 feet, and compressor stations at least 1,500 feet, from any occupied residential structure, community or institutional building. An exception may be granted from this requirement if the operator obtains the consent of the owner of the residential structure, or demonstrates that the drill pad and/or compressor station will be substantially hidden from view, and that the noise levels experienced will not exceed ambient noise levels.

ii. Measures to be used to mitigate visual impacts associated with facilities may include, but are not limited to:

- Minimizing the size of structures;
- Minimizing damage to vegetation and the use of vegetation to buffer visual impacts;
- Minimizing work pad size to that area necessary to provide a safe work area;
- Locating facilities away from prominent features, hilltops and ridges;
- Locating facilities at the base of slopes;
- Painting permanent facilities in uniform, non-contrasting, non-reflective color tones slightly darker than the adjacent landscape;
- Directing exterior lighting, when required, away from residential areas, or effectively shielding the light from such areas;
- Applying one or more of the following landscape practices for permanent facilities:
    - Establishing berms, ground covers, shrubs and trees;
    - Placing vegetation clusters 10-15 feet apart along the edge of the permanent pad site in residential areas, using native species;
    - When clearing trees and vegetation for construction of facilities, feather and thin edges of the clearing;
    - Shaping cuts and fills to appear as natural forms;
    - Cutting rock areas to appear as natural forms;
    - Designing the facility to utilize natural screens; and,
    - Constructing fences, such as woven wood or rock, for use with landscaping.

iii. Measures to be used to mitigate potential noise impacts associated with facilities and compressor stations will be considered on a site-specific basis. The operator will provide an analysis of the noise impacts on residential and commercial users of the proposed project area, and sensitive public facilities including community or institutional buildings. Measures to mitigate noise impacts may include but are not limited to:

- Venting exhaust in a direction away from the closest existing residences of a platted subdivision;
- Using quiet design mufflers on non-electric motors;
- Limiting the hours of noise-generating operation to daytime hours;
- Using sound insulating enclosures where facilities would otherwise create noise impacts because of proximity, population density, and other adjacent land uses sensitive to adverse impacts from noise; and,
- Siting facilities and compressor stations in locations that use geographic features to buffer noise.

iv. Operators are required to make contact with the surface owner of lands upon which activities are proposed, and make good faith efforts to negotiate a surface use agreement. If agreement cannot be reached, ADNR may initiate bond proceedings pursuant to AS 38.05.130, but only if the operator demonstrates that a reasonable period of time has passed from the initial contact between the surface owner and operator, and the operator has made a good faith effort to reach an agreement. When determining the damage bond amount under AS 38.05.130, ADNR shall consider the current market value of the property, the potential duration of operations, the loss of use of the property during operations, potential cost of damage to existing surface improvements, crops, and timber. In addition, the bond terms will include provisions to ensure that any bond with a potential duration of greater than two years is periodically reviewed to ensure it remains set at a sufficient amount.

v. Timber harvested as part of exploration and development activities (including right-of-way and pad clearing) will be processed and disposed in a manner approved by the Division of Forestry.

c. Permanent facilities shall not be constructed during the exploration phase. Exploration activities must be supported by air service, an existing road system, ice roads, or by off-road vehicles that do not cause significant damage to the ground surface or vegetation. Construction of temporary drill pads, airstrips, and roads may be allowed.

d. The siting of temporary and permanent facilities other than docks, roads, and utility and pipeline crossings, will be prohibited within ½ mile of the banks of the Nenana and Savage Rivers, except where land use plans classify an area for industrial use, or established usage and use history show industrial use. Temporary and permanent facilities other than docks, roads, and utility and pipeline crossings will also be prohibited within 500 feet of all fish bearing water bodies and 1,500 ft of all current surface drinking water sources. Facilities may be sited within these buffers if the licensee demonstrates to the satisfaction of the director, in consultation with ADF&G, that site locations outside these buffers are not practicable or that a location inside the buffer is environmentally preferred.

   Road, utility, and pipeline crossings must be consolidated and aligned perpendicular or near perpendicular to watercourses.

e. Impacts to identified wetlands must be minimized to the satisfaction of the director, in consultation with ADF&G. The director will consider whether facilities are sited in the least sensitive areas. Further, all activities within wetlands require permission from the U.S. Army Corps of Engineers (see Licensee Advisories).

f. The operator will minimize disturbance of vegetation within rights-of-way during construction, maintenance, and operational activities.

g. Pipelines must utilize existing transportation corridors and be buried where conditions permit. In areas with above ground placement, they must be designed, sited, and constructed to allow for the free movement of wildlife. Pipeline gravel pads must be designed to facilitate the containment

and cleanup of spilled fluids. Pipelines must be designed and constructed to assure integrity against climatic conditions and geophysical hazards.

h. Gravel mining within an active floodplain is prohibited, unless the director, in consultation with ADF&G, determines that a floodplain mine site would enhance fish and wildlife habitat upon site closure and reclamation. Gravel mining in upland sites will be restricted to the minimum area necessary to develop the field in an efficient manner.

i. 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, the local borough, and any non-state surface owner determines that such removal and rehabilitation is not in the state's interest.

2. Fish and Wildlife Habitat

a. Detonation of explosives will be prohibited in open water areas of fish bearing streams and lakes. Explosives must not be detonated beneath, or in close proximity to, fish-bearing streams and lakes if the detonation of the explosive produces a pressure rise in the water body of greater than 2.7 pounds per-square-inch, or unless the water body, including its substrate, is solidly frozen. Detonation of explosives within or in close proximity to a fish spawning bed during the early stages of egg incubation must not produce a peak particle velocity greater than 0.5 inches per second. Blasting criteria have been developed by ADF&G and are available from ADF&G upon request. The location of known fish bearing waters within the project area can be obtained from ADF&G.

b. Compaction or removal of snow cover overlying fish bearing water bodies is prohibited except for approved crossings. If ice thickness is not sufficient to facilitate a crossing, ice or snow bridges may be required. See Licensee Advisory B(2).

c. Water intake pipes used to remove water from fish bearing water bodies must be surrounded by a screened enclosure to prevent fish entrainment and impingement. Screen mesh size shall be no greater than 1 mm (0.04 in) unless another size has been approved by ADF&G. The maximum water velocity at the surface of the screen enclosure may be no greater than 0.1 ft per second unless an alternative velocity has been approved by ADF&G.

d. Pipelines that must cross fish bearing streams will be constructed beneath those streams using directional drilling techniques, unless the director, in consultation with ADF&G, approves an alternative method.

e. Licensees are required to prepare and implement a human-bear interaction plan designed to minimize conflicts between bears and humans. The plan shall include measures to:

   i. minimize attraction of bears to facility sites, including garbage and food waste;
   ii. organize layout of buildings and work areas to minimize interactions between humans and bears such as including the use of electric fencing;
   iii. warn personnel of bears near or on facilities and the proper actions to take;
   iv. if authorized, deter bears from the drill site;
   v. provide contingencies in the event bears do not leave the site;
   vi. provide for proper storage and disposal of materials that may be toxic to bears; and
   vii. document and communicate the sighting of bears onsite or in the immediate area to all shift employees.

f. Before commencement of any activities, licensees shall consult with ADF&G to identify the locations of known bear den sites that are occupied in the season of the proposed activities. Exploration and development activities started between October 15 and April 30 may not be conducted within ½-mile of known occupied brown bear dens, unless alternative mitigation

measures, as described in a bear-human interaction plan (see Mitigation Measure A(2)(e)), are approved by the director in consultation with ADF&G. Discovery of an occupied bear den not previously identified by ADF&G must be reported to the Division of Wildlife Conservation, ADF&G, within 24 hours (Fairbanks, 907-459-7233). Mobile activities shall avoid such discovered occupied dens by ½-mile unless alternative mitigation measures, as described in a bear-human interaction plan (see Mitigation Measure A(2)(e)), are approved by the director in consultation with ADF&G. Non-mobile facilities will not be required to be relocated.

g. The director, in consultation with ADF&G, may impose seasonal restrictions on activities located in, or requiring travel through or overflight of, important moose and caribou calving and wintering areas.

h. The director, in consultation with ADF&G, may impose seasonal restrictions on activities located in important waterfowl habitat during the plan of operations approval stage.

3. Subsistence, Commercial and Sport Harvest Activities

a. License-related use will be restricted when the Commissioner determines it is necessary to prevent unreasonable conflicts with local subsistence, commercial and sport harvest activities. In enforcing this term DO&G, during review of plans of operation or development, will work with other agencies and the public to identify and avoid potential conflicts. In order to avoid conflicts with subsistence, commercial and sport harvest activities, restrictions may include alternative site selection, directional drilling, seasonal drilling restrictions, and other technologies deemed appropriate by the Commissioner.

4. Fuel and Hazardous Substances

a. Secondary containment (see definitions) shall be provided for the storage of fuel or hazardous substances.

b. Containers with a storage capacity larger than 55 gallons that contain fuel or hazardous substances shall not be stored within 100 ft of a waterbody or within 1,500 ft of a current surface drinking water source.

c. During equipment storage or maintenance, the site shall be protected from leaking or dripping fuel and hazardous substances by the placement of drip pans or other surface liners designed to catch and hold fluids under the equipment, or by creating an area for storage or maintenance using an impermeable liner or other suitable containment mechanism.

d. During fuel or hazardous substance transfer, secondary containment or a surface liner must be placed under all container or vehicle fuel tank inlet and outlet points, hose connections, and hose ends. Appropriate spill response equipment, sufficient to respond to a spill of up to 5 gallons, must be on hand during any transfer or handling of fuel or hazardous substances. Trained personnel shall attend transfer operations at all times.

e. All independent fuel and hazardous substance containers shall be marked with the contents and the licensee's or contractor’s name using paint or a permanent label.

f. The operator will maintain Material Safety Data Sheet (MSDS) information on any hazardous substances currently used by the operator at facilities within the license area. The operator will ensure the emergency services director, and local fire service area office is provided information concerning the use or transport of any hazardous substances associated with exploration and development. The operator will post at each drill site and facility the contact name and phone number from whom interested persons can obtain information regarding any hazardous materials used at the drill site or facility.

g. Vehicle refueling shall not occur within the annual floodplain, except as addressed and approved in the plan of operations.

5. Waste Disposal

a. Waste from operations must be reduced, reused, or recycled to the maximum extent practicable. Garbage and domestic combustibles remaining after reuse or recycling must be incinerated whenever possible or disposed at an approved site in accordance with ADEC regulations.

b. On-site temporary storage of waste will not be permitted for longer than six months; the operator will exclude people, domestic animals and wildlife from solid waste disposal areas using fencing or other barriers approved by DO&G. Open pit solid waste storage is not allowed in residential areas. In these areas, solid waste must be stored in a closed container.

c. New solid waste disposal sites, other than for drilling waste, will not be approved or located on state property during the exploration phase of license activities. Disposal sites may be provided for drilling waste if no practicable alternative exists, and the facility complies with ADEC regulations.

d. Wherever practicable, the preferred method for disposal of muds and cuttings from oil and gas activities is by underground injection. Other methods of disposal shall be allowed only upon approval by the director, in consultation with ADEC and ADF&G. Drilling muds and cuttings may not be discharged into lakes, streams, rivers, or wetlands. On-pad temporary cuttings storage will be allowed. Impermeable lining and diking, or equivalent measures, will be required for reserve pits.

6. Access

a. Public access to, or use of, the license area may not be restricted except within the immediate vicinity of drill sites, buildings, and other related facilities. Areas of restricted access must be identified in the plan of operations. Facilities and operations shall not be located so as to block access to or along navigable or public waters as defined in AS 38.05.965.

7. Prehistoric, Historic, and Archeological Sites

a. Before the construction or placement of any gravel or other structure, road, or facility resulting from exploration, development, or production activities, the licensee must conduct an inventory of prehistoric, historic, and archeological sites within the area affected by an activity. The inventory must include consideration of literature provided by nearby communities, Native organizations, and local residents; documentation of oral history regarding prehistoric and historic uses of such sites; evidence of consultation with the Alaska Heritage Resources Survey and the National Register of Historic Places; and site surveys. The inventory must also include a detailed analysis of the effects that might result from the activity.

b. The inventory of prehistoric, historic, and archeological sites must be submitted to the director, and to DPOR Office of History and Archaeology who will coordinate with the local borough government for review and comment. If a prehistoric, historic, or archeological site or area could be adversely affected by an activity, the director, after consultation with DPOR Office of History and Archaeology, will direct the licensee as to the course of action to take to avoid or minimize adverse effects.

c. If a site, structure, or object of prehistoric, historic, or archaeological significance is discovered during license operations, the licensee must report the discovery to the director as soon as possible. The licensee must make reasonable efforts to preserve and protect the discovered site, structure, or object from damage until the director, after consultation with the DPOR Office of

History and Archaeology, has directed the licensee as to the course of action to take for its preservation.

8. Local Hire, Communication, and Training

a. The licensee is encouraged to employ local and Alaska residents and contractors for work performed in the license area to the extent they are available and qualified. Licensees shall submit, as part of the plan of operations, a proposal detailing the means by which the licensee will comply with this measure. The proposal must include a description of the operator's plans for partnering with local communities to recruit, train, and hire local and Alaska residents and contractors. In formulating this proposal, the licensee is encouraged to coordinate with employment services offered by the State of Alaska and local communities and to recruit employees from local communities.

b. A plan of operations application must describe the licensee's past and prospective efforts to communicate with local communities and interested local community groups.

c. A plan of operations application must include a training program for all project personnel, including contractors and subcontractors. The program must be designed to inform each person working on the project of environmental, social, and cultural concerns that relate to that person's job. The program must use methods to ensure that personnel understand and use techniques necessary to preserve geological, archeological, and biological resources. In addition, the program must be designed to help personnel increase their sensitivity and understanding of community values, customs, and lifestyles in areas where they will be operating.

9. Definitions

Community or institutional building means any structure that is used primarily for meetings, gatherings or functions of local civic organizations or other community groups; or that functions as an educational, cultural, historic, religious, scientific, correctional, mental health or physical health care facility.

Facilities means any structure, equipment, or improvement to the surface, whether temporary or permanent, including, but not limited to, roads, pads, pits, pipelines, power lines, generators, utilities, airstrips, wells, compressors, drill rigs, camps and buildings.

Practicable means feasible in light of overall project purposes after considering cost, existing technology, and logistics of compliance with the mitigation measures.

Geophysical hazard means the following natural processes or adverse conditions that present a threat to life or property in the area of operations: flooding, earthquakes, active faults, landslides, ice formations, snow avalanches, and erosion.

Identified wetlands are those areas that have been identified as wetlands by the U. S. Army Corps of Engineers under Section 404 of the Clean Water Act.[1].

Hazardous substance means (A) an element or compound that, when it enters into or on the surface or subsurface land or water of the state, presents an imminent and substantial danger to the public health or welfare, or to fish, animals, vegetation, or any part of the natural habitat in which fish, animals, or wildlife may be found; or (B) a substance defined as a hazardous substance under 42 USC 9601 - 9675 (Comprehensive Environmental Response, Compensation, and Liability Act of

1 ***Wetlands*** means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR Parts 122.2, 230.3, and 232.2).

1980); “hazardous substance" does not include uncontaminated crude oil or uncontaminated refined oil (AS 46.09.900).

Minimize means to reduce adverse impacts to the smallest amount, extent, duration, size, or degree reasonable in light of the environmental, social, or economic costs of further reduction.

Occupied residential dwelling means any building that is used either temporarily, occasionally, seasonally, or permanently for human habitation. Any structure used only for commercial, agricultural, industrial, retail, or other commercial purposes is excluded.

Permanent facility means a facility that will remain at a single location for a period in excess of six months, excluding exploration wells.

Plan of operations means a license plan of operations under 11 AAC 83.158 and a unit plan of operations under 11 AAC 83.346.

Secondary containment means an impermeable diked area or portable impermeable containment structure capable of containing 110 percent of the volume of the largest independent container. Double walled tanks do not qualify as secondary containment unless an exception is granted for a particular tank.

Sensitive public facility means a hospital, school, public library, or court building.

Subdivision means a collection of land parcels whose legal description is determined by a single plat recorded at the state Recorders Office.

B. Other Regulatory Requirements (Licensee Advisories)

Licensees must comply with all applicable local, state and federal codes, statutes and regulations, as amended. Licensee advisories alert licensees to additional restrictions that may be imposed at the permitting stage of a proposed project or activity where entities other than DO&G have regulatory, permitting, or management authority. This list is not exhaustive, and it is the responsibility of the licensee to know and comply with all applicable laws and regulations.

1. Alaska Department of Natural Resources,

a) Licensees must include in their seismic permit applications a plan for notifying the public of their activities (11 AAC 96).

b) Forest clearing for seismic exploration must have prior approval by DO&G in consultation with the Division of Forestry and ADF&G.

c) Removal of gravel from state land must have prior approval from DMLW. Licensees must submit a material sale application (AS 38.05.110-120, AS 38.05.810, 11 AAC 71.045) as well as a development plan, environmental risk questionnaire, and Alaska Coastal Management Plan questionnaire. Applicants are required on state, federal, municipal, and private land to submit a reclamation plan or letter of intent per AS 27.19.030-050.

2. Alaska Oil and Gas Conservation Commission

a. AS 31.05.030(j) states that, for exploration and development operations involving nonconventional gas (coalbed methane), the commission may not issue a permit to drill if the well would be used to produce gas from an aquifer that serves as a source of water for human consumption or agricultural purposes unless the commission determines that the well will not adversely affect the aquifer as a source of water for human consumption or agricultural purposes; or allow injection of produced water except at depths below known sources of water for human consumption or agricultural purposes.

In addition, AOGCC shall regulate hydraulic fracturing in nonconventional gas wells to ensure protection of drinking water quality; regulate the disposal of wastes produced from the operations unless the disposal is otherwise subject to regulation by the DEC or EPA; and, as a condition of approval of a permit to drill a well for regular production of coalbed methane, require the operator to design and implement a water well testing program to provide baseline data on water quality and quantity and make the results of the water well testing program available to the public.

3. Alaska Department of Fish and Game

a. Under the provisions of AS 41, the measures listed below may be imposed by ADF&G below the ordinary high water mark to protect designated anadromous fish-bearing streams and to ensure the free and efficient passage of fish in all fish-bearing water bodies. Specific information on the location of anadromous water bodies in and near the area may be obtained from ADF&G.

   i. Alteration of riverbanks may be prohibited.

   ii. The operation of equipment, excluding boats, in open water areas of rivers and streams may be prohibited.

   iii. Bridges or non-bottom founded structures may be required for crossing fish spawning and important rearing habitats.

   iv. Culverts or other stream crossing structures must be designed, installed, and maintained to provide free and efficient passage of fish.

b. Removal of water from fish-bearing water bodies is subject to the regulations for the Appropriation and Use of Water (11 AAC 93.035-.147) and ADF&G statutes AS 16.05.841 and AS 16.05.871.

4. Alaska Department of Environmental Conservation

a. The licensee must comply with state regulations administered by ADEC (18 AAC 75.425) regarding requirements for an approved oil discharge prevention and contingency plan (C-Plan) prior to commencing operations.

b. Unless authorized by an ADEC permit, surface discharge of reserve pit fluids and produced waters is prohibited.

c. Surface disposal of produced water will not be allowed unless ADEC determines that the discharge will meet state water quality standards.

d. Unless authorized by NPDES or state permits, disposal of wastewater into freshwater bodies is prohibited.

5. U.S. Corps of Engineers

a. Any activity involving wetland-related dredge or fill activities requires a permit from the USCOE.

6. U.S. Fish and Wildlife Service

a. Bald eagles are protected under the Bald Eagle Protection Act (16 USC 668-668c) and the Migratory Bird Treaty Act of 1918 (16 USC 703-712). Licensees are responsible to ensure their actions do not take bald eagles. The Eagle Protection Act defines “take” to include disturbing birds. A survey for bald eagle nests is necessary prior to beginning exploration or development activities during the nesting period (March 1 through August 31). Any nests located within ½-mile of the project site must be mapped, and destruction of nest trees or locations is prohibited. If

any nests are located within ½-mile of a project site, licensees shall meet with the USFWS prior to construction to review any site-specific concerns regarding the subject nest. USFWS generally recommends no clearing of vegetation within 330 feet of any nest. No activity should occur within 660 feet of any nests between March 1 and June 1. Between June 1 and August 31, no activity should occur within 660 feet of active eagle nests until after juvenile birds have fledged, unless specifically authorized by the USFWS. While the USFWS can recommend ways to avoid the take of eagles, final accountability lies with the party responsible for the action.

b. Licensees are advised that they must comply with the Migratory Bird Treaty Act (MBTA) (16 USC 703) which is administered by the USFWS. Under the Migratory Bird Treaty Act, it is illegal to "take" migratory birds, their eggs, feathers, or nests. "Take" is defined (50 CFR 10.12) to include "pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting." The MBTA does not distinguish between "intentional" and "unintentional" take. Migratory birds include songbirds, waterfowl, shorebirds, and raptors. In Alaska, all native birds except grouse and ptarmigan, which are protected by the State of Alaska, are protected under the MBTA.

c. To ensure compliance with the MBRA, it is recommended that licensees survey the project area prior to construction, vegetation clearing, excavation, discharging fill, or other activities which create disturbance, and confirm there are no active migratory bird nests. It is recommended that licensees contact the USFWS for assistance and guidance on survey needs, and other compliance issues under the MBTA. While the USFWS can recommend methods, such as surveys and timing windows, to avoid unintentional take, responsibility for compliance with the MBTA rests with the licensee.

Appendix A: Summary of Comments and Responses

Table of Contents

Table of Contents (continued)

List of Tables

Appendix A: Summary of Comments and Responses

AS 38.05.035(e)(7)(B) requires that final best interest findings include a summary of agency and public comments received and the department's responses to those comments. This appendix summarizes public comments received in response to the Preliminary Finding of the Director for the Healy Basin Exploration License issued on August 31, 2005.

A. Common Issues

This section contains common issues raised during the public comment period and ADNR's responses.

1. Property Values

Comment Summary: Some commenters stated that issuing this license will negatively affect local property values, and that it has been estimated that property values will decrease by 20% if CBM occurs in the areas now planned.

ADNR Response: A study by BBC Research and Consulting estimated a 22% reduction in selling prices for houses with coalbed methane wells on the property in La Plata County, Colorado, from 1990 to 2000 (BBC 2001). However, wells located farther from the center of properties sold within the study area, at distances of greater than 550 ft and up to 2,600 ft, had a modest impact, if any, on the value of the property. It is unclear how applicable this property assessment is to the Healy area because of Healy's smaller population and more rural setting.

ADNR has researched and visited coalbed methane development sites in Colorado and Wyoming and finds that the development and leasing statutes are significantly different. Alaska's are more protective of environmental and surface owner interests. Also, the Healy exploration license includes both conventional and non-conventional (coalbed methane) natural gas while development and leasing in the other areas addressed just coalbed methane.

Mitigation measures and other regulatory protections protect fish and wildlife populations and their habitats, and local and other uses. Each of these measures contributes to protecting property values. Mitigation measures A(1)(a) and A(1)(b) specifically address avoiding, minimizing, or mitigating impacts to property values. These require contacting property owners, and address road and access issues, and sight and sound impacts.

2. Tourism

Comment Summary: Some commenters stated that tourism and recreation are very important to the local economy and depend on natural land, unobstructed views, scenic beauty, and quiet surroundings.

ADNR Response: Multiple uses can occur on state lands and gas development is compatible with other uses such as hunting, fishing, and tourism. Mitigation measures and licensee advisories are designed to protect diverse aspects of local habitats, species, local uses, and other uses and values. Each of these measures, in turn, help protect recreational values. Specific measures are imposed to minimize noise and disruption from new facilities and to protect viewshed, air and water quality, habitat, fish and wildlife species, and public access, among others. Mitigation Measures A(1)(a), (b), (d), A(3)(a), and A(6)(a)1 specifically protect recreational areas, activities, and other uses and values.

3. Water Quality

Comment Summary: Some commenters were concerned that issuing the exploration license will impact water quality. They stated that wells may dry up or be polluted, local aquifers will be depleted due to extensive pumping of groundwater, and surface waters will be degraded from disposal of produced water, and therefore that ADNR needs to implement water quality monitoring.

ADNR Response: The wastewater permitting requirements of ADEC, discussed in Chapter 7, Sections B(4) and E(3), protect the waters of the state by ensuring that state water quality standards are met. Similarly the EPA, under the authority of the Clean Water Act, ensures that federal water quality standards are met. Both goals are achieved through implementation of the NPDES permitting system, delegated to ADEC for implementation via the Alaska Pollution Discharge Elimination System. The licensee is required to comply with these permits (see Licensee Advisories B(4)).

The preferred disposal method is to dispose of drilling fluids deep in the ground, although other means of discharge may be authorized (Mitigation Measure A(5)(d)). AOGCC regulates wastewater re-injection. The goal of re-injection is to inject the waste deep enough so there is no communication between it and the groundwater. Reasonably foreseeable effects of the license on water quality are discussed in Chapter Eight, and laws and regulations governing water quality are discussed in Chapter Seven.

Plan of operations approvals include monitoring requirements to mitigate potential impacts on water quality (Mitigation Measure A(1)(a)(v)). Monitoring requirements will be tailored to the specific situation and potential impacts.

Under AS 31.05.030(j), AOGCC requires the operator of an unconventional gas well to design and implement a water well testing program to provide baseline data on water quality and quantity, and make the results available to the public. Further, the law prohibits AOGCC from permitting a well if the well would be used to produce unconventional gas from an aquifer that serves as a source of water for human consumption or agricultural purposes, unless it determines that the well will not adversely affect the aquifer as a source of water for human consumption or agricultural purposes.

4. Air Quality

Comment Summary: Some commenters were concerned that air quality will suffer due to increased emissions. They stated that the finding needs to provide specific measures that will be taken to minimize the air quality impacts, and that there should be thresholds for air quality that would trigger limits on all new well infrastructure development.

ADNR Response: At the licensing phase, the type and amount of pollutants that may be produced cannot be predicted, but all industrial emissions must comply with the Clean Air Act (42 USC §§ 7401-7642) and state air quality standards. State regulations provide for air quality control through permit requirements, permit review criteria, and regulation compliance criteria. State regulations designate air quality standards for the construction, operation, or modification of natural gas facilities.

The Alaska State Air Quality Control Plan and state regulations address air emissions in Alaska. The Healy area is classified as Class II air shed and an air quality attainment area; this designation allows a moderate incremental decrease in the air quality of the area. Baseline concentrations of pollutants and portions of the increments already consumed are determined by the EPA and the State of Alaska prior to issuing air quality permits. ADEC monitors compliance with regulations and air quality standards through annual inspections and uniform enforcement procedures. ADEC's air quality program controls significant, stationary sources of air contaminants to protect and enhance air quality and to abate impacts on public health and the environment. The agency issues operating permits to existing major facilities incorporating all applicable requirements, and issues construction

permits to new, large facilities and for expansions of existing facilities. See Chapter Eight. Chapter Seven discusses laws and regulations governing air quality.

5. Local Use of Energy

Comment Summary: Some commenters stated that even with development, inexepensive energy will likely not be available for local consumption, and that UCM has confirmed that it is unlikely that gas would be delivered locally. Some commenters stated that even if it were delivered locally, the savings over heating oil would be small when compared to the potential loss of property value and loss of quality of life from environmental impacts of development.

ADNR Response: The availability of gas for local consumption will depend on the location of the discovery and the relative costs of building a transportation system to deliver it to homes in the area or to other locations. At this time, whether or not gas would be available for local consumption is unknown, and is therefore appropriately framed as a "possibility."

6. Noise

Comment Summary: Some commenters were concerned that the noise standards set out in the preliminary finding will not be sufficient to protect residential values and the Healy area.

ADNR Response: Noise as a potential effect is discussed in Chapter Eight. Mitigation Measure A(b) requires facilities to be designed and operated to minimize sight and sound impacts in areas of residential, commercial, recreational, and subsistence use and important wildlife habitat. Additionally, plans of operation approvals will include requirements to minimize potential noise and/or visual impacts to adjacent uses, tailored to the specific situation and potential impacts (Mitigation Measures A(1)(a) and A(1)(b)).

7. Area West of the Nenana River

Comment Summary: Some commenters stated that the area west of the Nenana River should be removed from the license area.

ADNR Response: Removing the area west of the Nenana River from the license area may make the project economically unfeasible. The imposition of mitigation measures to avoid, minimize, or mitigate potential impacts is preferable to removing a large acreage from the license area. As specific projects are proposed, additional mitigation measures may be imposed. Given these measures, licensee advisories, and existing laws and regulations, removing the area west of the Nenana River from the license area is unnecessary. See Common Issue 8 for further discussion regarding the Wolf Townships.

8. Denali National Park and Preserve and the Wolf Townships

Comment Summary: Some commenters expressed concern that the license will imperil wildlife and tourism in Denali National Park and Preserve (DNPP). For example, they stated that none of the mitigation measures are specifically designed to protect the park, there are no setbacks from the park boundary, and there is no protection for the Denali Caribou Herd. Some stated that the northern ANILCA additions to the park were intended to provide protection to the ecosystem utilized by wildlife; and that when ANILCA was passed, it was recognized that some omissions remained, primarily the Wolf Townships west of Healy, a portion of which are within the license area. The National Park Service's Land Protection Plan of 1986 identified the Wolf Townships as a top priority for further protection.

ADNR Response: The license area is entirely within land in which the state owns the subsurface resources. NPS does not have authority to manage state land or impose additional setbacks. Mitigation measures and licensee advisories are designed to protect diverse aspects of habitats,

species, local uses, and other uses and values. Each of these measures, in turn, will help protect recreational values, fish and wildlife populations and habitats, scenic views, and adjacent landowners such as NPS.

The Wolf Townships are owned by the state and are not included in DNPP. The 1988 DNPP wilderness Environmental Impact Statement, mandated by Section 1317 of ANILCA, recommended the addition, as described in the 1986 Land Protection Plan, and NPS proposed adding the Wolf Townships and other areas to the park. The Secretary of the Interior did not forward the proposal to Congress.

Use of this area by caribou and wolf has been added to Chapter Four. Mitigation Measure A(2)(g) allows the director, in consultation with ADF&G, to impose seasonal restrictions on activities located in, or requiring travel through or overflight of, important moose and caribou calving and wintering areas.

9. Wildlife Habitat Fragmentation

Comment Summary: Some commenters were concerned that development could lead to habitat fragmentation and impacts on wildlife.

ADNR Response: Mitigation measures provided in this finding, combined with evaluation and approval authority for all plans of operation, will provide protection for fish and wildlife populations and habitats. Further, ADNR may impose additional conditions on approvals of plans of operation when specific activities in specific locations have been proposed. Most of the mitigation measures and other regulatory requirements specifically address fish and wildlife populations and habitats or provide additional indirect protections to them (see Chapter Nine).

10. Private Property Rights and Bonding Requirements

Comment Summary: Some commenters stated that property owners have no legal means to prevent drilling on their property, and that the current $25,000 bond per lease may not be sufficient to mitigate damages.

ADNR Response: As explained in Chapter Three, Section B, when state land is conveyed to an individual citizen, local government, or other entity, state law requires that the deed reserve the mineral rights for the state. State law reserves to the state the right to reasonable access to the surface for purposes of exploring for, developing and producing the reserved mineral. Surface owners are entitled to damages under AS 38.05.130, which also requires notice and ensures the opportunity of the land owner to be heard; however, they may not deny reasonable access.

Mitigation Measure A(2)(b)(iv) requires operators to make contact with the surface owner of land upon which activities are proposed and make good faith efforts to negotiate a surface use agreement. If agreement cannot be reached, ADNR may initiate bond proceedings pursuant to AS 38.05.130, but only if the operator demonstrates that a reasonable period of time has passed from the initial contact between the surface owner and operator, and the operator has made a good faith effort to reach an agreement. When determining the damage bond amount under AS 38.05.130, ADNR shall consider the current market value of the property, the potential duration of operations, the loss of use of the property during operations, potential cost of damage to existing surface improvements, crops, and timber. In addition, the bond terms will include provisions to ensure that any bond with a potential duration of greater than two years is periodically reviewed to ensure it remains set at a sufficient amount.

11. Coalbed Methane Versus Conventional Gas Exploration

Comment Summary: Some commenters made statements regarding exploration for coalbed methane specifically as opposed to conventional gas exploration or exploration for gas in general.

ADNR Response: The license does not make a distinction between coalbed methane and natural gas in general, although AS 38.05.180(gg)(2)(A) and (B) does address setbacks and mitigation of noise from coalbed methane development. The final finding, including mitigation measures, addresses gas exploration in general, although there is some discussion specific to coalbed methane.

12. Best Interests of Local Residents

Comment Summary: Some commenters noted that the preliminary best interest finding stated that "the revenue stream to the state from the proposed exploration license and any downstream production is not expected to significantly impact the overall oil and gas revenue of the state of Alaska. The best interests of local residents is therefore of critical importance to the best interest decision." Some commenters stated that if the economic return from the project will be insignificant, then the exploration license proposal should be rejected.

ADNR Response: The anticipated revenue from the Healy exploration license is unlikely to cause a significant percentage increase compared to the state's total revenue from oil and gas activities. However, because the potential for shallow coalbed gas in the Healy area is estimated to be high, this project could contribute to state revenues. The potential of coal as a significant source of clean-burning natural gas in Alaska is promising, although production of natural gas resources from coal has yet to be fully developed. The level of contribution to state revenues is unknown at this time, and will depend on the outcome at every project phase, and ultimately on levels of gas production.

However, it is important to note that contribution to state revenue is not the only issue that the director must consider. For example, the potential availability of natural gas on the road system close to the communities of central and Southcentral Alaska could have a positive impact beyond the value of royalty income to the state.

It is also important to note that although local interests are critical in making a decision about issuing exploration licenses, local interests are not overriding or prioritized above all other interests. In making the decision of whether or not the exploration license is in the best interests of the state, the director weighed the many different aspects of the exploration license, including local concern and support, and balanced environmental protection with development to ensure that multiple uses can occur on state lands and that development of gas resources is compatible with other uses in the area. The director's consideration of local concerns is reflected in Mitigation Measures A(1)(a)-(i) which address issues such as impacts to local property owners, road and access issues, and sight and sound impacts.

B. Other Comments from Organizations

Written comments were received from 19 agencies, organizations, or businesses (Table A.1). This section provides a summary of those comments, arranged in alphabetical order by organization, and ADNR's responses.

Table A.1. Organizations, agencies, and businesses that submitted comments on the preliminary finding.

Organization	Name	Location
ADNR, Office of Habitat Management and Permitting (OHMP)[1]	Robert McLean, Area Manager	Anchorage, AK
ADNR, Office of History & Archaeology	Judith E. Bittner, State Historic Preservation Officer	Anchorage, AK
Agrium, Kenai Nitrogen Operations	William A. Boycott, General Manager	Kenai, AK
Alaska Earth Resources, Inc.	David W. Lappi, Director	Anchorage, AK
Alaska Railroad Corporation	Michael Fretwell, Manager, Land Services	Anchorage, AK
Colville, Inc.	Keith Silver, Vice President Finance	Prudhoe Bay, AK
Denali Borough Assembly	Gerald Pollock, Presiding Officer	Healy, AK
Denali Citizens Council	Nancy Bale, President	Denali Park, AK
Denali National Park Wilderness Centers	Jenna Hamm, Company Officer	Denali Park, AK
Kantishna Air Taxi & Skyline Lodge	Greg LaHaie, Owner	Denali Park, AK
Lynden	David W. Haugen, Vice President	Anchorage, AK
National Park Service, Denali National Park & Preserve	Paul R. Anderson, Superintendent	Denali Park, AK
National Parks Conservation Assoc.	Jim Stratton, Alaska Regional Director	Anchorage, AK
Northern Alaska Environmental Center	Kaarle Strailey	Fairbanks, AK
Panquingue Creek Homeowners Association		Healy, AK
Resource Development Council	Tadd Owens, Executive Director	Anchorage, AK
Teamsters Local 959	Mike Kenny, Secretary-Treasurer	Anchorage, AK
Trustees for Alaska	Vicki Clark, Staff Attorney	Anchorage, AK
Usibelli Coal Mine, Inc. and Usibelli Energy LLC	Mitchel D. Usibelli, Manager and Steve W. Denton, Vice President Business Development	Healy, AK

[1] The Office of Habitat Management and Permitting (OHMP) of the Alaska Department of Natural Resources became the Division of Habitat, a part of the Alaska Department of Fish and Game (ADF&G), effective July 1, 2008, as a result of Executive Order 114.

1. ADNR, Office of Habitat Management and Permitting[2] (Robert McLean, Area Manager)

Anchorage, AK. Letter of October 25, 2005

Comment Summary: The Office of Habitat Management and Permitting (OHMP) provided information on the organization and information flow between OHMP and ADF&G.

ADNR Response: In the intervening time, OHMP has been moved back into ADF&G and is now the Division of Habitat.

Comment Summary: OHMP requested a mitigation measure specifically protecting salmon spawning areas within the Nenana River floodplain, the June Creek and Lignite Springs areas, and other areas.

ADNR Response: Several mitigation measures provide protection to rivers and salmon spawning areas in the license area. Mitigation Measure A(1)(d) provides setbacks from the Nenana and Savage rivers and from all fish-bearing water bodies, and the licensee must obtain required permits from ADF&G for many activities that could affect fish-bearing streams or fish passage (Licensee Advisory B(3)).

Comment Summary: OHMP requested that the mitigation measure addressing temporary storage of waste include consultation with ADF&G, and that the storage be designed to withstand seasonal flooding without loss of containment or adverse effects on the surrounding lands and waters.

ADNR Response: The setbacks required by Mitigation Measure A(1)(d) provide adequate protection from seasonal flooding.

Comment Summary: OHMP requested that the bear interaction plan be moved from the Lessee Advisory section to the Mitigation Measures section.

ADNR Response: Bear interaction plans now constitute a mitigation measure (Mitigation Measure A(1)(e)) rather than a licensee advisory.

Comment Summary: OHMP recommended other specific mitigation measures addressing use of explosives, off-road travel, anadromous stream crossings and water withdrawals, wetlands, siting and design of pipelines, gravel mining, conflicts with subsistence, public access, fish passage, disposal of garbage, activities around bear dens, bear/human interactions plans, and buffers around fish-bearing streams.

ADNR Response: Most of the mitigation measures recommended by OHMP are included in the final finding. Some were modified for consistency with mitigation measures for other areas. Requirements for screen mesh size and surface water velocity were modified for consistency with mitigation measures for other areas around the state; pipeline height was not specified in the mitigation measures to ensure that free movement of wildlife can be accommodated in a wide variety of situations.

2. ADNR, Office of History and Archaeology (Judith Bittner, State Historic Preservation Officer)

Anchorage, AK. Letter of October 31, 2005

Comment Summary: ADNR, Office of History and Archaeology stated that there are numerous reported archaeological sites and various locales of medium to high archaeological potential within

[2] The Office of Habitat Management and Permitting (OHMP) of the Alaska Department of Natural Resources became the Division of Habitat, a part of the Alaska Department of Fish and Game (ADF&G), effective July 1, 2008, as a result of Executive Order 114.

the license area, and that its office recommends that once the applicant defines areas where ground disturbing activities will occur, the necessary information be forwarded to its office for proper review. In so doing, the applicant will remain in compliance with AS 41.35.070, the Alaska Historic Preservation Act.

ADNR Response: The licensee must comply with the Alaska Historic Preservation Act. Cultural and historic resources are discussed in Chapters Three and Eight. Site-specific and project-specific mitigation measures may be imposed as necessary, if exploration and development take place. Mitigation Measures A(7)(a-c) are designed to address potential impacts to cultural and historical resources. The licensee must conduct an inventory of prehistoric, historic, and archaeological sites within the area affected by an activity. The inventory must be submitted to the director and to the State Historic Preservation Officer (SHPO); the director will consult the SHPO and direct the licensee to take action to avoid or minimize adverse effects. If new sites are discovered, the licensee must report the discovery to the director. The director will consult with the SHPO and direct the licensee to take appropriate action.

3. Agrium U.S. Inc. (William Boycott, General Manager)

Kenai, AK. Letter of October 24, 2005

Comment Summary: Agrium U.S. Inc. stated that it supports the Healy area exploration license, that in recent years, Agrium's operations have been limited by the lack of available gas, and that this project has the potential to provide feedstock to its facility in ensuing years.

ADNR Response: Support noted.

Comment Summary: Agrium U.S. Inc. stated that studies and analysis done by ADNR demonstrate the need to bring additional natural gas or alternate fuels on line by approximately 2012 to meet the needs of Southcentral Alaska, and that because of its proximity to existing infrastructure, the Healy area represents a excellent opportunity to demonstrate that shallow gas development can be accomplished responsibly.

ADNR Response: Comment acknowledged.

Comment Summary: Agrium U.S. Inc. recommended including a provision encouraging surface owners and exploration companies to work together in advance of any activities to reach mutually agreeable solutions to mitigate any conflicts.

ADNR Response: This provision is contained in Mitigation Measure A(1)(b)(iv) (see also Common Issue 10), and Mitigation Measure A(1)(a) requires the licensee to submit a copy of the proposed plan of operations to all surface owners whose property will be entered, and to all owners of surface lands within ½-mile of the proposed work site who can be reasonably identified and located. Plans of operations address access, visual impacts, noise, soil erosion, water quality, and monitoring.

4. Alaska Earth Resources, Inc. (David W. Lappi, Director)

Anchorage, AK. Letter of September 30, 2005

Comment Summary: Alaska Earth Resources, Inc. stated that issuing the exploration license is in the best interests of the state, and that resource development is one of the few business opportunities available in central Alaska that will provide employment and educational opportunities. It stated that the supply and high cost of LNG, which must be hauled to Fairbanks, limits the number of customers; and that if natural gas were more readily available, costs related to purchase and storage of bulk fuels would decrease. It also stated that a positive effect would be avoidance of liquid fuel spills, and that using natural gas rather than diesel would be an environmental benefit.

ADNR Response: Support noted. Potential positive and negative effects on air quality are discussed in Chapter Eight, Section C(1); potential effects on local communities, such as employment, are discussed in Chapter Eight, Section G(2).

5. Alaska Railroad Corporation (Michael Fretwell, Manager, Land Services)

Anchorage, AK. Letter of October 29, 2005

Comment Summary: The Alaska Railroad Corporation (ARRC) stated that it has concerns that the finding does not adequately describe the land ownership within the license area, and that ARRC is a major land owner in the Healy area, with approximately 6,885 acres of land.

ADNR Response: Map 3.1 in Chapter Three has been amended to show ARRC land ownership in the exploration area, and the text in Chapter Three has been amended to describe ARRC as a land owner in the license area.

Comment Summary: ARRC stated that its land ownership in the exploration area is significant because ARRC owns all land and mineral estates on its lands, and that as a result, any exploration activities that require access onto ARRC lands will require prior approval and a permit issued by ARRC.

ADNR Response: Only state-owned mineral estates will be included in the license. If ARRC does not own the mineral estate, ARRC is subject to the same laws and protections afforded other surface owners. See Common Issue 10.

6. Colville, Inc. (Keith Silver, Vice President, Finance)

Prudhoe Bay, AK. Letter of October 25, 2005

Comment Summary: Colville, Inc. made requests for changes to mitigation measures addressing disposal of muds and cuttings, summer exploration activities, setbacks, and consent requirements.

ADNR Response: Mitigation Measure A(d) states that the preferred method for disposal of muds and cuttings is by underground injection. However, Mitigation A(c) allows that disposal sites may be provided for drilling wastes if no practicable alternative exists. Mitigation Measure A(c) allows exploration activities to take place from existing roads and by off-road vehicles that do not cause significant damage to the ground surface or vegetation. Exceptions to the setbacks may be granted if the operator obtains consent from the owner. Setbacks from fish-bearing streams are consistent with other areas.

Comment Summary: Colville, Inc. stated that this exploration license is an opportunity to show that shallow gas development is feasible because it is relatively close to existing infrastructure and markets; and that experience and knowledge gained in the Healy area could have positive effects on shallow gas development throughout Alaska, which would increase diversity of supply for the Southcentral and Interior regions.

ADNR Response: Chapter Eight, Section G(1) discusses the issue of natural gas supply in Southcentral Alaska. Chapter Two, Section B discusses the intent of exploration licensing.

Comment Summary: Colville, Inc. stated that the state should encourage surface owners and exploration companies to work in advance to reach mutually agreeable solutions to mitigate conflicts between surface and subsurface users.

ADNR Response: Mitigation Measure A(1)(a) requires that plans of operation must be provided to all surface owners and owners within ½-mile of the proposed work site. Mitigation Measure

A(1)(b)(iv) requires that operators make contact with surface owners and make good faith efforts to negotiate surface use agreements.

7. Denali Borough Assembly (Gerald Pollock, Presiding Officer)

Healy, AK. Letter of October 17, 2005

Comment Summary: The Denali Borough Assembly stated that at its regular meeting on October 12, 2005, the Denali Borough Assembly voted unanimously that the Assembly is reserving comment at this point in the process, but that the Denali Borough is reserving the right to comment on the Healy Basin exploration license applied for by UCM at a future date.

ADNR Response: Public notice and comment procedures are specified in AS 38.05.035(e) and AS 38.05.945. Comments must be submitted during the period established in the finding. No person or entity may reserve the right to comment outside the public comment period.

8. Denali Citizens Council (Nancy Bale, President)

Denali Park, AK. Letter of October 31, 2005

Comment Summary: The Denali Citizens Council stated that comments from local residents regarding local impacts from CBM exploration and development activities must be given serious consideration since ADNR acknowledges that the economic return for the exploration license may be insignificant. The council stated that the identified benefits of the license are highly speculative, while the costs to the residents are potentially great and could include decreases in property values, other non-economic values; impacts to recreational lands; and decreased tourism and tourism growth potential.

ADNR Response: ADNR has considered the comments from local residents and has addressed those concerns. The mitigation measures included in the finding (Chapter Nine) are designed to balance environmental protection with development to ensure that multiple uses can occur on state lands, and that natural gas development is compatible with other uses such as tourism. In addition, the licensee is required to comply with all federal, state, and local laws and regulations.

Comment Summary: The council stated that the final finding should include a specific plan for additional oversight, public notice, and accountability when and if exploration converts to development. The council stated that the final best interest finding should provide a more detailed description of the affected environment and a more detailed cost-benefit analysis of the project. In addition, it stated that the finding should stipulate that local citizens will have the opportunity to reconsider whether or not this activity, undertaken on all of these lands, is in their best interests at the time of future exploration and development activities, as well as when the license is converted to a lease.

ADNR Response: The finding complies with AS 38.05.035 and AS 38.05.131-134, which govern the issuance of an exploration license, the conversion of a license to a lease, and public notice. The director of DO&G determines whether the proposed license is in the best interest of the state. The state has included many mitigation measures and licensee advisories to avoid, minimize, or mitigate impacts of the license on local communities, habitat, and species. Additional measures may be imposed in the plan of operations, when a specific exploration or development project is proposed. The license is also subject to state and federal laws and regulations.

Comment Summary: The council stated that Mitch Usibelli confirmed that it is unlikely that gas would be delivered locally, and that even if it were delivered locally, the savings over heating oil would be small when compared to the potential loss of property value. The council requested that this element be deleted from the final best interest finding as a potential benefit; or that if it continues

to be listed as a benefit, the finding include an analysis demonstrating the positive feasibility of providing gas locally at a price less than that of heating oil.

ADNR Response: See response to Common Issue 5.

Comment Summary: The council stated that the best interest finding should examine whether local labor is likely to be utilized because most of the people who are included in unemployment statistics for the area have summer jobs in the tourism or other service industries. The council stated that if there is little or no local employment, there is no local benefit, and that outside labor will likely be brought in, which could also bring many new social problems to the community.

ADNR Response: The finding addresses local labor conditions. Locally owned and operated companies may also provide services to the licensee or operators and may hire additional staff to meet the increased workload. Local contracts for resources and services, such as gravel and road construction, might also contribute to the local economy. Labor supplies in the local communities may not be able to meet demands for some technical positions. As a result, these jobs may be filled by workers from the service support industry that is active in other regions of the state or outside Alaska.

Comment Summary: The council requested that the final best interest finding consider the primary value of wildlife and wild lands in the Healy area, for individual quality of life, for tourism-based livelihoods, and for the natural integrity of the Denali National Park and Preserve. The council stated that the final finding must fully consider the diversity of wildlife in the Healy area, that National Park Service studies of caribou in the Wolf Townships are absent, that the value of this habitat as winter range for the Denali Caribou Herd is well documented, and that wolves commonly follow the caribou and are present in the Wolf Townships during winter months. The council noted that the finding does not acknowledge that the park's caribou and wolves inhabit the license area, cites no studies related to the effects of habitat fragmentation, and offers no mitigation measures of relevance to the Denali Caribou Herd.

ADNR Response: See responses to Common Issues 2, 7, 8, and 9. Information on the Denali Caribou Herd, wolves, and the Wolf Townships has been added to the final finding.

Comment Summary: The council urged ADNR to not grant an exploration license in the portion of the proposed exploration area utilized by Denali's caribou and other wildlife, notably T 12S, R 9W, T 12S, R 8W, and the portion of the T 11s, R 8W west of the Nenana River.

ADNR Response: Sighting locations for Denali caribou are denser farther west, north, and south, outside the license area. Mitigation Measure A(2)(g) allows for seasonal restrictions to protect calving and wintering caribou and moose and therefore, year-round prohibition of activities is unnecessary. See Common Issue 8.

Comment Summary: The council stated that the final best interest finding should analyze data on moose density in the several areas of Game Management Units 20A and 20C, and should recognize trails and areas that are most often used for hunting. The council also stated that use of these trails during gas exploration and development will likely change the patterns of human use, and may reduce access for these activities.

ADNR Response: Mitigation Measure A(3)(a) addresses conflicts with subsistence and sport harvest activities, allows the Commissioner to restrict license-related activities if necessary, and provides for identification of potential conflicts during review of plans of operation. Mitigation Measures A(6)(a) addresses access, and prohibits the licensee from restricting access to the license area, except in the immediate vicinity of drill sites, buildings, and other related facilities.

Comment Summary: The council stated that the final finding must provide a more detailed analysis of soil types throughout the license area in order to reveal specific locations where wetlands,

wet soils and permafrost will make road and pipeline construction both more expensive and more damaging; and that using soil criteria to exempt certain wetlands and sensitive areas from gas development is appropriate before issuing an exploration license.

ADNR Response: Wetlands are discussed in Chapter Four. Wetlands in the Healy Basin have been mapped by the USFWS National Wetlands Inventory. Any activity involving dredging or filling wetlands requires a permit from the U.S. Army Corps of Engineers (Licensee Advisory B(5)(a)); and impacts to identified wetlands must be minimized and facilities sited in the least sensitive areas (Mitigation Measure A(1)(e)).

Comment Summary: The council stated that the final best interest finding must provide assurance to local residents that their best interests will be protected by standards that recognize a rural baseline of residential density and noise, and that the noise standards set out in the preliminary best interest finding will not be sufficient to protect residential values and the Healy area.

ADNR Response: Mitigation Measure A(1)(a)(v) requires a monitoring plan that considers potential noise; Mitigation Measure A(1)(b) requires that facilities be designed and operated to minimize sound impacts; Mitigation Measure A(1)(b)(i) stipulates setbacks; and Mitigation Measure A(1)(b)(iii) addresses measures to be used to mitigate potential noise impacts.

Comment Summary: The council stated that the small lot subdivision exclusion is inadequate for the Healy area; that a more realistic standard should require that no drill pads, compressor stations, or access roads be located in any residential subdivision where the lots are 10 acres or less, without the consent of all the landowners in the subdivision; and that there should be a minimum one-mile setback around the outside of subdivisions.

ADNR Response: The small lot subdivision exclusion has been replaced by a setback requiring that drill pads be sited at least 500 ft and compressor stations at least 1,500 ft from any occupied residential structure, community or institutional building (Mitigation Measure A(1)(b)).

Comment Summary: The council stated that the final best interest finding should stipulate that a landowner has the right to refuse entry upon his/her property if he/she so chooses.

ADNR Response: See response to Common Issue 10.

Comment Summary: The council stated that the final best interest finding should be more specific on how ADNR will protect water quality and water wells borough-wide. They stated that although there is no discussion of this subject in the preliminary finding, one of the overriding issues of produced water disposal is that of poor water quality of CBM produced water. They stated that the best interest finding should be modified to include which of the three methods of produced water disposal (discharge into existing stream channels, holding ponds, reinjection) is being proposed or considered by the licensee, and that the final best interest finding should prohibit surface disposal of produced water and should stipulate that reinjection is the only practicable method of disposal for this water.

ADNR Response: See response to Common Issue 3 and Chapter Eight for more information about water quality, including disposal of produced water. Mitigation Measure A(1)(a)(vii) prohibits surface disposal of produced water unless ADEC determines that the discharge will meet state water quality standards and the director has approved the water management plan.

Comment Summary: The council stated that the final best interest finding must provide greater protection for air quality throughout the Denali Borough; that even though air quality is covered under existing statutes and regulations, ADNR should still develop air quality mitigation measures; and that the best interest finding does not adequately identify the harm to local residents and communities that could arise from a decrease in air quality in the area.

ADNR Response: See response to Common Issue 4 and Chapter Eight.

Comment Summary: The council stated that the best interest finding needs to address reclamation, that the developer should be required to remove facilities from private and public property and to remove roads and drill pads, and that bonding should be required for the full amount necessary to remove improvements and plug abandoned wells.

ADNR Response: Mitigation Measure A(1)(i) addresses dismantlement, removal, and remediation The surface owner may also negotiate a surface use agreement with the licensee. Mitigation Measure A(1)(b)(iv) states that, if the licensee is unable to reach an agreement with the surface owner, ADNR may initiate bond proceedings, but only if the licensee has made a good faith effort to negotiate an agreement. See Common Issue 10 for a discussion of bonding.

Comment Summary: The council stated that ADNR should declare it not in the best interest of the state or local citizens to explore for or develop gas in those parts of the license area west of the Nenana River.

ADNR Response: See response to Common Issue 7.

9. Denali National Park Wilderness Centers (Jenna Hamm, Company Officer)

Denali Park, AK. Letter of October 30, 2005

Comment Summary: Denali National Park Wilderness Centers stated that public should have the opportunity to comment on other phases of the Healy project.

ADNR Response: Chapter Two, Section F explains that there are opportunities for public comment in phases in addition to the licensing phase.

Comment Summary: The Centers stated that exploration or natural resource extraction should not be allowed anywhere west of the Nenana River or within close proximity to dwellings anywhere east of the river.

ADNR Response: See response to Common Issue 1, 7 and 10. Mitigation Measures A(1)(a) and (b) provide setbacks and other protections for residential areas.

Comment Summary: The Centers stated that protection of air and water quality throughout the lease area should be guaranteed.

ADNR Response: Potential effects on air and water quality are discussed in Chapter Eight, Sections B and Section C. Mitigation Measures A(1)(a)(iii) and (vii), A(1)(d), A(1)(e), A(4)(a)-(g), A(5)(a)-(d), and Lessee Advisory B(2)(a) and B(4)(a)-(d) protect air and water quality in the area.

Comment Summary: The Centers stated that more information about wetlands should be included in the finding, and that mitigation measures specifically addressing wetlands should be added.

ADNR Response: Wetlands are adequately discussed in Chapter Four, Section A(2). Mitigation Measure A(1)(e) requires that impacts to wetlands be minimized, and states that all activities within wetlands require permission of the U.S. Army Corps of Engineers. Licensee Advisory B(5) also reminds licensees that a permit is required from the U.S. Army Corps of Engineers for any activity involving dredge or fill activities in wetlands.

Comment Summary: The Centers stated that information about the Wolf Townships and Denali Caribou Herd, as well as other information on wildlife populations and use is lacking.

ADNR Response: See response to Common Issue 8; other information was also added to the final finding as appropriate.

Comment Summary: The Centers stated that landowner rights and values should be protected.

ADNR Response: See response to Common Issue 1 and 10.

Comment Summary: The Centers stated that the benefits to local residents should be identified.

ADNR Response: Chapter Eight, Section H discusses benefits to local residents.

10. Kantishna Air Taxi and Skyline Lodge (Greg LaHaie, Owner)

Denali Park, AK. Letter of October 10, 2005

Comment Summary: Kantishna Air Taxi and Skyline Lodge stated that issuing the exploration license is not in their best interest, and that the costs outweigh the benefits.

ADNR Response: Opposition noted.

11. Lynden (David W. Haugen, Vice President)

Anchorage, AK. Letter of October 24, 2005

Comment Summary: Lynden stated that it is in the best interest of the state of Alaska to grant the exploration license because there is a great need for natural gas in the railbelt region and UCM's exploration in this area will be of great benefit to all of Alaska. Lynden stated that the Healy area represents an excellent opportunity to demonstrate the feasibility of shallow gas development because of its proximity to existing infrastructure and markets.

ADNR Response: Support noted.

Comment Summary: Lynden stated that ADNR should issue the license without excluding any areas of state-owned land in the license area because some of the deepest areas of the basin are located in areas where private ownership exists, that these deep areas may hold the greatest promise for conventional gas reservoirs, and that existing protections for surface owners are adequate to address possible conflicts between surface and subsurface uses.

ADNR Response: Comment acknowledged.

Comment Summary: Lynden stated that there are very few domestic water wells in potential gas-producing areas, and that in most cases hundreds of feet separate the bottom of such wells from potential gas producing zones. Lynden stated that where conflicts may exist, the state has appropriate controls in place to eliminate or mitigate impacts on domestic water wells.

ADNR Response: Comment acknowledged.

Comment Summary: Lynden stated that the setback restrictions from rivers and fish bearing streams are excessive, and that because this is a gas only lease and the potential for encountering oil is extremely remote, setbacks for facilities do not need to be any more stringent than for any other industrial facility.

ADNR Response: The director must balance environmental protection with development to ensure that multiple uses can occur on state lands and that oil and gas development is compatible with other uses. Mitigation Measures A(1)(b)(i) and A(2)(d) strike this balance by stipulating setbacks, but also providing for exceptions under certain circumstances.

12. National Park Service, Denali National Park and Preserve (Paul Anderson, Superintendent)

Denali Park, AK. Letter of October 31, 2005.

Comment Summary: Denali National Park and Preserve (DNPP) stated that it is concerned that gas exploration and development on lands adjacent to the park could have serious and long-term negative impacts to park resources. He stated that of particular concern are townships 12S, 9W; 12S,

8W; and 11S, 8W, because of their proximity to the park lands, and that the significance of these lands to DNPP function was addressed in the ANILCA Senate report section 202(3), primarily because of their importance to wildlife populations.

ADNR Response: See response to Common Issue 8.

Comment Summary: DNPP stated that it recommends that the director re-evaluate whether the project review should be a multi-phased review because the licensing procedure will set in motion a chain of events that can lead to an irretrievable commitment by the state to issue lease rights. It stated that CBM development scenarios could be analyzed at this phase by the state because they are well documented elsewhere, and that park resources, as well as park-based tourism, will be better served by a careful evaluation of the potential effects of CBM development prior to issuing a license.

ADNR Response: An exploration license grants the licensee exclusive rights to explore for natural gas; however an exploration license does not authorize subsequent activities. The licensee's rights to explore for gas that may underlie the lands included in the exploration license are subject to the terms of the license, plans of operation approvals and any stipulations thereto, subsequent leases, and all applicable state and federal laws and regulations. Chapter Seven contains a discussion of many of the required permits, including the associated public processes.

AS 38.05.035(h) provides: “the director may not be required to speculate about future effects subject to future permitting that cannot reasonably be determined until the project or proposed use for which a written best interest finding is required is more specifically defined.” At the licensing phase, it is not possible to predict the extent of development prior to exploration. Estimating gas reserves is a complex process, and even with the most technologically advanced scientific tools, exploration is required to determine if economically recoverable gas is present, and what conditions are present. It is possible that no discoveries will be made and no development will take place. If development does take place, mitigation measures included in the final finding and any necessary additional stipulations will avoid, minimize, or mitigate potential negative impacts.

Phased review allows consideration of licensing to focus only on the issues pertaining to the licensing phase and the reasonably foreseeable significant effects of licensing. Phased review of this project is appropriate. Chapter Two discusses phasing in greater detail. See also Common Issue 11.

Comment Summary: DNPP stated that the preliminary finding fails to explicitly evaluate or include any specific measures that protect the DNPP from exploration and subsequent development in the proposed license area.

ADNR Response: The same measures, laws, and regulations that protect the license area will protect adjacent areas. See response to Common Issues 2 and 8.

Comment Summary: DNPP stated that gas exploration and development could negatively impact air quality and air quality related values within the park’s Class I airshed. It stated that although the preliminary best interest finding indicates that air quality concerns will be addressed during future phases of review, proposed development on the border of the park should take into consideration potential effects on the park’s Class I airshed before the exploration license is awarded.

DNPP stated that the proximity of the project to the park’s airshed should be further considered, and that the license and lease stipulations should require that exploration and development activities implement the lowest achievable emission rates. It stated that cumulative impacts should be assessed and that the licensee should be required to conduct air quality monitoring in or near the park before exploration or development activities are conducted.

ADNR Response: See response to Common Issue 4. ADEC enforces the Clean Air Act in Alaska and Alaska’s air quality standards, which include the designation of Class I for DNPP and Class II for the license area.

Comment Summary: DNPP stated that although many of the precise site-specific aspects of future CBM development cannot presently be determined, conventional production scenarios exist that can be used to assess potential impacts. It stated that those scenarios include the need to pump large quantities of groundwater and produced water, which is typically discharged into surface drainages. It stated that DNPP is concerned about the future integrity of the park's surface waters and the hydraulic integrity of the park's stream channels, and it suggested that any watershed draining into the park be excluded from the exploration license.

ADNR Response: See responses to Common Issues 3 and 11.

Comment Summary: DNPP stated that the Tanana Basin Area Plan classifies the Wolf Townships for wildlife habitat and recreation use, that the easternmost of these townships is included in the license area, and that ANILCA also recognizes the Wolf Townships as important habitat for park wildlife populations.

ADNR Response: See response to Common Issue 8. The Tanana Basin Area Plan allows oil and gas leasing throughout the Tanana Basin. ANILCA does not regulate state lands. A reference to DNPP maps showing caribou sightings has been added to the final finding.

Comment Summary: DNPP stated that the preliminary best interest finding did not include the Denali Caribou Herd, which occurs in the park and uses a portion of the license area as critical winter habitat. It stated that to protect wildlife viewing opportunities for visitors to DNPP, it is important that threats to the Denali Caribou Herd are minimized. It stated that habitat fragmentation from road construction and development of well pads, compressor stations, power lines and reservoirs would adversely impact available caribou habitat.

ADNR Response: See response to Common Issues 8 and 9.

Comment Summary: DNPP stated that it recommends that a more thorough assessment of wildlife habitat use patterns, as well as potential displacement from gas exploration and development activities, be developed before finalizing the best interest finding. It stated that it should be noted, for example, that several townships in the license area are within the range of wolves from several packs whose territories are almost exclusively within DNPP, and that the same area is important winter habitat for moose that spend the rest of the year within the park.

ADNR Response: See response to Common Issue 8.

Comment Summary: DNPP stated that there are currently no exotic plant species outside the park road corridor, and that DNPP is concerned that gas exploration and development activities adjacent to the park would provide corridors for invasive plants to encroach upon park lands. DNPP also stated that rare plants listed by the Alaska National Heritage Program are located along the southwest boundary of the license area and inside the park, and could be threatened by gas exploration and development activities.

ADNR Response: Exploration and development on state land in accordance with state law, including the applicable requirements of 11 AAC 34 (regulating seeds and noxious weeds), is no different from other activity in this respect. Public use of DNPP and the Healy Basin carry the same risks. Mitigation Measures 4, 7, and 8 help address impacts to vegetation.

Comment Summary: DNPP stated that its management policies establish that natural soundscapes are intrinsic elements of the park environment and are part of the resources and values that DNPP is responsible for protecting, and that the proposed sound mitigation measures would not be sufficient to protect the natural soundscapes.

ADNR Response: See Common Issue 6. Noise standards included in the final finding are sufficient to protect natural soundscapes in DNPP, especially since DNPP is, in most cases, many miles from the license area and is separated from most of the area by the Parks Highway and Nenana River.

Mitigation Measure A(1)(b)(iii) requires an analysis of the noise impacts on residential and commercial users of the project area, and recommends measures to be used on a site-specific basis.

Comment Summary: DNPP stated that the local economy significantly depends on the park and the tourism it generates, that the finding puts DNPP on an equal footing with other landowners adjacent to the license area, and fails to take into account the importance of the park to the nation's and the state's citizens. It stated that DNPP recommends that the license exclude lands within the three townships adjacent to the park.

ADNR Response: See response to Common Issues 2 and 8.

13. National Parks Conservation Association (Jim Stratton, Alaska Regional Director)

Anchorage, AK. Letter of October 31, 2005.

Comment Summary: National Parks Conservation Association (NPCA) stated that Denali National Park is the center of tourism in the northern Susitna Valley and Alaska's interior, but that exploration and development allowed in the best interest finding would put the park's most important resources and this long term, sustainable economy at risk. NPCA stated that development of natural gas, particularly using CBM extraction techniques, is not in the best interest of the park or the state.

ADNR Response: See responses to Common Issue 2 and 11.

Comment Summary: NPCA stated that the most important resource imperiled by the development is the park's wildlife. It stated that the northern ANILCA additions to the park were intended to provide protection to the ecosystem utilized by the wildlife; that at the time of ANILCA, it was recognized that some omissions remained, primarily the "Wolf Townships" west of Healy, a portion of which is within the license area; that the National Park Service's Land Protection Plan of 1986 identified the wolf townships as top priority for further protection; and that the National Park Service has modeled the most important areas for the Denali Caribou Herd, which include Fairbanks meridian townships T 12S, R 9W, T 12S, R 8W, and T 11S, R 8W.

ADNR Response: See response to Common Issue 8.

Comment Summary: NPCA stated that the finding fails to mention the fact that the Denali Caribou Herd depends on a portion of the license area during winter months, that the finding does not adequately address impacts of habitat fragmentation, and that the finding does not include any mitigation that would be applicable to the Denali Caribou Herd.

ADNR Response: See response to Common Issues 8 and 9. Information about the herd has been added to the final finding, and Mitigation Measure A(2)(g) allows for seasonal restrictions for important caribou and moose calving and wintering areas.

Comment Summary: NPCA stated that the finding does not address impacts of the gas project on local and statewide tourism industries, and that impacts of gas development activities on tourism businesses in the Healy area are not included, even though park-related tourism pays for 85% of borough government expenses.

ADNR Response: See response to Common Issue 2. Tourism is discussed in Chapter Three and Chapter Eight.

Comment Summary: NPCA stated that the best interest finding is inadequate in its protection of air quality. It stated that a fact sheet produced by the Geologic Resources Division of the National Park Service at the NPS Western Energy Summit, January 21-23, 2003 concluded that the primary impact potential for lands outside of CBM developed areas is air quality. It stated that the best interest finding identifies most of the sources of air pollutants associated with CBM, but it does not mention

that traffic on newly-constructed gravel roads can create excessive airborne road dust. NPCA stated that Denali National Park and Preserve is designated a Class I airshed, and that the best interest finding needs to provide: (1) specific measures that will be taken to minimize air quality impacts; (2) thresholds for air quality impacts below the maximums allowed by regulations that would trigger limits on new development; and (3) a commitment that air quality within the park will not be allowed to decline from current conditions for reasons attributable to this project.

ADNR Response: See response to Common Issue 4 and 11, and Chapter Eight.

Comment Summary: NPCA stated that the National Parks Conservation Association is concerned about the potential for surface disposal of water in areas that would affect the national park or wildlife that crosses park boundaries into the license area or areas downstream of the license area. It stated that, as the best interest finding notes, if water is released into streams, it can raise water levels and cause erosion and the drowning of vegetation along stream banks. NPCA stated that the license area encompasses part of the watershed of the Savage and Teklanika rivers, which flow north through the park, that produced water from CBM is often high in contaminants, and that reinjection should be required.

ADNR Response: See response to Common Issue 3 and Chapter Eight.

14. Northern Alaska Environmental Center (Kaarle Strailey)

Fairbanks, AK. Letter of October 28, 2005.

Comment Summary: Northern Alaska Environmental Center (NAEC) stated that to avoid environmental, health, and economic degradation that has been associated with developments in other parts of the country, it is important for Alaska to proceed with the advantage of lessons learned elsewhere and factoring multiple considerations into the permitting processes.

ADNR Response: ADNR has researched and visited coalbed methane development sites in Colorado and Wyoming and finds that the development and leasing statutes are significantly different. Alaska's are more protective of environmental and surface owner interests. See also response to Common Issue 11.

Comment Summary: NAEC stated that decisions on water disposal are unclear in the best interest finding, although these decisions could have considerable implications for the environment and water supply of local residents. NAEC stated that because the state does not require displaced water to be reinjected or captured, the potential exists for large amounts of water, much of it saline, to be wasted, to contaminate ground water supplies, to sterilize soils, or to draw down the water table.

ADNR Response: ADEC ensures that the state's water quality standards are met. See response to Common Issue 3.

Comment Summary: NAEC stated that pressurized CBM could contaminate local water wells with methane, but that no description of baseline water data is included in the preliminary best interest finding, and that there is no requirement that private land owners be compensated if their well or water supply is damaged.

ADNR Response: See response to Common Issue 3. In addition, it is important to note that methane may occur naturally in water wells.

Comment Summary: NAEC stated that surface property owners have no legal means to prevent drilling on their property, that many landowners will lose their personal value in the land, and that CBM wells on private property at the time of sale lead to a significant net reduction in selling price.

ADNR Response: See responses to Common Issues 1 and 10.

Comment Summary: NAEC stated that CBM will impact the natural landscape because each wellhead requires a gravel pad of up to several acres, and rural tranquility will be lost to the industrial noise. It stated that the proposed noise limits would allow urban levels of noise at residences.

ADNR Response: Mitigation Measure 8 contains several provisions to safeguard landscapes. See Common Issue 6.

Comment Summary: NAEC stated that surface property owners should be involved in all discussions, that decisions should not be made over their objections, and that private property surface user agreements should be on record with the state prior to approval of licensing.

ADNR Response: AS 38.05.035(e) and 38.05.945 address the public notice and review process for this finding and subsequent activities; public participation is invited at each phase of activity. See Common Issue 10.

Comment Summary: NAEC stated that because of the long-term impacts of drilling, a standard maximum bond rate should not be set. He stated that the current bond may not be sufficient to mitigate damages, that each parcel should be evaluated on its own merits, and that an environmental impact statement for each plot would assist ADNR in its bonding decision and inform the public of the effect of the lease.

ADNR Response: See Common Issue 10. ADNR sets a bond only if the parties cannot reach agreement.

Concerning Environmental Impact Statements (EIS), in specifying the process for best interest findings, the legislative intent language for SB308 (Eighteenth Legislature) Section 1(7) (Ch. 38 SLA 1994) explicitly states that ADNR is not required to conduct an EIS:

> Analyses comparable to those generally required by 42 USC 4321-4370a (National Environmental Policy Act of 1969, as amended) for the preparation of an environmental impact statement under 42 USC 4332(2)(C) are not required by the state for support of best interest findings issued under AS 38.05 or conclusive coastal zone consistency determinations issued under AS 46.40.

An EIS process is not required for the Healy exploration license.

Comment Summary: NAEC stated that if CBM development results in the building of new power plants and a resultant increase in emissions, it could negatively impact the ecosystem, which directly affects the economy linked to the national park. It stated that even if emissions meet state and federal standards, they will still bring about a decline over the exceptionally clean air of the area at present.

ADNR Response: See response to Common Issue 4.

Comment Summary: NAEC stated that the best interest finding fails to mention that a portion of the lease area encompasses critical winter habitat for the Denali Caribou Herd, and that during the summer, these are the most viewed caribou in Alaska, and potentially the world.

ADNR Response: See response to Common Issue 8.

Comment Summary: NAEC stated that a cost-benefit analysis to local people should be presented, that the best interest finding does not demonstrate that locals who need work have the skills necessary to fill the created positions, and that there is not a reasonable way to estimate the number or quality of new jobs that will be created.

ADNR Response: The final finding addresses local labor conditions. Locally owned and operated companies may also provide services to the licensee or operators, and may hire additional staff to meet the increased workload. Local contracts for resources and services, such as gravel and road

construction, might also contribute to the local economy. Labor supplies in the local communities may not be able to meet demands for some technical positions. As a result, these jobs may be filled by workers from the service support industry that is active in other regions of the state, or outside Alaska.

Comment Summary: NAEC stated that installing natural gas distribution infrastructure to serve local residents would be expensive if not prohibitive, and that economic savings of households provided by natural gas may not realistically make up for the loss of property value and loss of quality of life from the environmental impacts of development

ADNR Response: See response to Common Issue 5.

15. Panguingue Creek Subdivision Homeowners Association

Healy, AK. Letter of October 27, 2005

Comment Summary: The Panguingue Creek Subdivision Homeowners Association PCHA stated that the Healy project is inconsistent with the goals of the PCHA and is not in the best interests of the landowners within and adjacent to the subdivision. The PCHA stated that the mitigation measures should state that no drill pads, compressor stations, or access roads would be located in any residential subdivision where the majority of the lots are 10 acres or less without the consent of all the landowners in the subdivision, and that no drill pads or compressor stations be allowed on any parcel of 20 acres or less without the consent of the landowner. The PCHA stated that this more expansive mitigation measure would benefit surface landowners but have minimal effects on the license applicant because much of the land in the license area is publicly owned.

The PCHA stated that tracts within the subdivision should be specifically excluded from drill pads, compressor stations, or access roads because Panguingue Creek has salmon runs downstream of the subdivision, and because the subdivision consists mostly of creeks and steep hillsides where the siting of facilities would be impossible.

The PCHA stated that CBM development within the subdivision would violate private property rights and negate the reasons that most people acquired and established residences in the area, specifically because the neighborhood is quiet, rural, scenic, and close to undeveloped recreation lands. The PCHA requested that the subdivision be excluded from all development activities, that a one-mile minimum buffer be established around the neighborhood that would exclude all development activities, and that oil and gas drilling and exploration activities be restricted to the current Usibelli coal lease area.

The PCHA also expressed concerns about noise, effects to aquifers, surface water disposal, road development, response plans, and visual impacts.

ADNR Response: See responses to Common Issues 1, 3, 4, 6, 7, 10, and 11. Mitigation Measures A(1)(a) and (b) will protect the Panguingue Subdivision.

16. Resource Development Council (Tadd Owens, Executive Director)

Anchorage, AK. Letter of October 31, 2005

Comment Summary: The Resource Development Council (RDC) stated it supports the exploration license and that no state-owned lands should be excluded because the areas of most promise may be in areas of private surface ownership. RDC stated that existing protections are adequate to address conflicts and that surface owners and exploration companies should work together to reach mutually agreeable solutions.

ADNR Response: Support noted. Mitigation Measure A(1)(a) and (b), A(3)(a), and A(6)(a) address potential conflicts with surface owners and uses.

Comment Summary: RDC stated that setbacks along rivers and streams are excessive.

ADNR Response: Setbacks to protect fish-bearing water bodies and certain rivers are consistent with mitigation measures for other areas. Exceptions may be granted where land use plans classify an area for industrial use, or established usage and use history show industrial use. Exception may also be granted if locations outside the buffers are not practicable or if a location inside the buffer is environmentally preferred.

Comment Summary: RDC stated that setbacks for drill pads and compressor stations are excessive.

ADNR Response: Mitigation Measure A(1)(b)(i) was changed. In the final finding, this measure allows changes to the setback with the consent of the landowner, and provides for exceptions under certain circumstances.

Comment Summary: RDC stated that summer exploration activities should be allowed.

ADNR Response: Mitigation Measure A(1)(c) allows exploration activities that are supported by existing roads or by off-road vehicles that do no damage to the ground surface or vegetation.

Comment Summary: RDC stated that onsite disposal of muds and cuttings should be allowed.

ADNR Response: Mitigation Measure A(d) states that the preferred method for disposal of muds and cuttings is by underground injection. However, Mitigation A(c) allows that disposal sites may be provided for drilling wastes if no practicable alternative exists.

Comment Summary: RDC stated that the exploration license is an opportunity to show that shallow gas development is feasible because of it is relatively close to existing infrastructure and markets; and that experience and knowledge gained in the Healy area could have positive effects on shallow gas development throughout Alaska, which would increase diversity of supply for the Southcentral and Interior regions.

ADNR Response: Chapter Eight, Section G(1) discusses the issue of natural gas supply in Southcentral Alaska. Chapter Two, Section B discusses the intent of exploration licensing.

17. Teamsters Local 959 (Mike Kenny, Secretary-Treasurer)

Anchorage, AK. Letter of October 31, 2005

Comment Summary: The Teamsters stated that they support the Healy exploration license and believe that exploration can be done in an environmentally safe manner that will provide jobs not only for Teamsters, but for many Alaskans throughout the state.

ADNR Response: Support noted. Mitigation Measures A(8)(a-c) 34 address local hire.

Comment Summary: The Teamsters requested that summer exploration, including seismic work, be allowed on a case-by-case basis because much of the area has extensive, pre-existing road and trail systems and has well-drained foothills where summer travel over the surface can be done with minimal damage to the surface. It stated that because of the steep terrain, a temporary road system may be needed to access exploration sites, and that construction of such roads in the summer would be safer and more likely to be cost effective.

ADNR Response: Mitigation Measure A(1)(c) allows temporary roads on a case-by-case basis.

Comment Summary: The Teamsters stated that the Healy area represents an opportunity that could demonstrate the feasibility of developing shallow gas, in light of its proximity to existing

infrastructure and markets, and that the Healy development could be used as a model and could have positive effects on other gas development throughout the state.

ADNR Response: Comment acknowledged.

18. Trustees for Alaska (Vicki Clark, Staff Attorney)

Anchorage, AK. Letter of October 31, 2005

Comment Summary: Trustees for Alaska (Trustees) stated that CBM exploration and development activities are likely to threaten resources valued by the local community, all Alaskans, and the nation as a whole.

ADNR Response: ADNR has researched and visited coalbed methane development sites in Colorado and Wyoming and finds that the development and leasing statutes are significantly different. Alaska's are more protective of environmental and surface owner interests. Note that the exploration license includes both conventional natural gas and unconventional natural gas, also referred to as coalbed methane.

With the mitigation measures presented in this finding and additional project-specific and site-specific mitigation measures imposed in response to specific proposals, the natural gas resources of the license area can be explored and developed without significantly affecting resources valued by the local community. The state has sufficient authority from general constitutional, statutory, and regulatory empowerments, the terms of the license agreement, and plan of operations permit terms to ensure that the licensee conducts activities safely and in a manner that protects the integrity of the environment and maintains opportunities for human uses.

Comment Summary: Trustees stated that the best interest finding does not meet constitutional requirements for analysis of this exploration license. Trustees stated that although Alaska law allows for restricted analysis in the best interest finding when the development is multi-phased, ADNR must consider "whether ADNR, through phasing its review, would 'avoid thorough review of the project or … avoid consideration of potential future environmental, sociological, or economic effects' or … whether phasing would 'result in disregard of the cumulative potential environmental impacts of a project.'" Kachemak Bay Conservation Soc'y v. State, Dep't of Nat. Resources, 6 P.3d 270, 280 (Alaska 2000) (citing Ch. 38 § 1(11), SLA 1994; and Thane Neighborhood Ass'n v. City and Borough of Juneau, 922 P.2d 901, 908 (Alaska 1996)). Trustees stated that the best interest finding states that "exploration over some portion of the license area is highly likely." ADNR is therefore constitutionally obligated to consider actual or potential exploration scenarios and their impacts to determine whether they are in the best interests of the state.

ADNR Response: As explained in detail in Chapter Two, Section F, phased review is statutorily authorized by AS 38.05.035(e)(1)(C), and the statutory criteria for phasing have been met for the Healy exploration license. The constitutionality of phasing is beyond the scope of a best interest finding. A best interest process for post-license phases is not required by statute. The commentary to the statute states that "no other best interest finding is required after the disposal phase."

SB 156 Sections 1 (c) and (d) state the legislature's purpose in amending AS 38.05.035 in 1994:

> Although the legislature did intend that there would be a detailed review of the project at any later phase, the legislature did not intend that the Department of Natural Resources would have to issue another best interest finding as part of the review…When passing the 1994 amendments, the legislature was aware that the post-disposal phases, which are exploration, development, and transportation, would be subjected to numerous federal, state, and local laws, regulations, policies, and ordinances; reviewed by numerous agencies; and subjected to public review and comment.

Chapter Seven describes many of the other permits and approvals required by local, state, and federal agencies for gas exploration, development, and production during post-license phases.

Comment Summary: Trustees stated that the best interest finding is the most important part of the oil and gas development process in terms of disclosing information, and that there are limited opportunities for public input as exploration and development progress.

ADNR Response: ADNR followed the statutorily-required process for best interest findings. Public participation is an important part of the natural gas licensing, exploration, and development process, and there are additional opportunities for public involvement at each phase of development.

Comment Summary: Trustees stated that the best interest finding acknowledges that "the revenue stream to the state from the proposed exploration license and any downstream production is not expected to significantly impact the overall oil and gas revenue of the state of Alaska. It stated that the best interest of local residents is therefore of critical importance to the best interest decision." Trustees stated that the economic return from the project will be insignificant, and that the exploration license proposal should therefore be rejected.

ADNR Response: See Common Issue 12.

Comment Summary: Trustees stated that issuing the exploration license may impact borough land selections and should be addressed in the final best interest finding. Trustees stated that in the past, ADNR rejected land selections in the Prudhoe Bay oil field by the North Slope Borough because it determined that the state control of those lands was necessary to maintain the state's best interests in those oil leases.

ADNR Response: Issuing the license does not prevent the State from conveying lands to the borough. The State retains the mineral estate for any lands conveyed to the borough.

Comment Summary: Trustees stated that the cumulative effects analysis is inadequate because it does not discuss any of the reasonably foreseeable projects in the license area. Trustees stated that although neither the best interest statute nor the regulations governing exploration licensing and leasing contain a definition of cumulative effects, the ACMP regulations found at 11 AAC 110.990(19) do: "cumulative impacts means reasonably foreseeable effects on a coastal use or resource that result from the incremental impact of an individual project when viewed together with the impacts of past and currently authorized projects."

Trustees stated that the best interest finding does not contain any discussion of past and currently-authorized projects (transportation projects, other oil and gas leasing activities, the Usibelli Coal Mine, or the Healy Clean Coal Project); it only discusses potential issues with CBM exploration activities.

ADNR Response: The best interest finding process is governed by statutes distinct from the ACMP process. Statutes governing the best interest finding process were followed in developing the best interest finding for the Healy exploration license. A phased review allows the best interest finding to focus on issues pertaining to licensing and its reasonably foreseeable significant effects. As discussed in detail in Chapter Two of the finding, phased review of this project is appropriate.

Legislative history indicates that for an effect to be "reasonably foreseeable": (1) there must be some cause and effect connection between the proposed disposal and the effect to be evaluated; (2) there is a reasonable probability that the effect will occur as a result of the disposal; and (3) the effect will occur within a predictable time after the disposal. A reasonably foreseeable effect must also be "significant," which means a known and noticeable impact on or within a reasonable proximity to the area involved in the disposal.

Chapter Eight of the finding, covering over 25 pages, is devoted to considering and discussing potential effects of the Healy exploration license. This chapter includes consideration and discussion

of effects on surface owners; effects on water, air quality, fish and wildlife populations and their habitats, recreational, subsistence, commercial, and sport uses; effects on historic and cultural resources; fiscal effects on the statewide economy and local communities; effects on the Denali Borough and communities; and effects on Denali National Park and Preserve.

Effects concerning unknown future projects are not included because speculation would be required about possible future effects subject to future permitting that cannot reasonably be determined until a project or proposed use is more specifically defined (AS 38.05.035(h)). Details that are unknown at this time include numbers, sizes, and types of projects that might occur as the result of the exploration license, and technology that may be available in the future.

Comment Summary: Trustees stated that the best interest finding fails to discuss potential road building activities in the transportation section. CBM will likely require many roads to service the infrastructure and those impacts must be addressed.

ADNR Response: Permanent new roads are prohibited during exploration. Gas pipelines are the most likely method of transporting gas from the study area. At the licensing phase, predicting the extent or location of any new gas transportation facilities is not possible. Roads are included in the finding in Chapter Six, Section C(1)(b) as related to the exploration phase and in Section E(1) as related to components of natural gas pipelines. Potential effects of roads are discussed throughout Chapter Eight of the finding.

19. Usibelli Coal Mine, Inc. and Usibelli Energy, LLC (Mitchel D. Usibelli, Manager and Steve W. Denton, Vice President Business Development)

Healy, AK. Letter of October 31, 2005

Comment Summary: Usibelli Coal Mine, Inc. and Usibelli Energy, LLC (collectively Usibelli) listed several typographical and other minor errors in the best interest finding.

ADNR Response: These have been corrected in the final best interest finding.

Comment Summary: Usibelli stated that the Healy Basin is a prime example of a license area that should qualify for an exemption from filing a C-Plan under the new measures resulting from HB 197. It stated that DO&G's gas only classification of the license area supports this, as stated in Section 6-C-1 and elsewhere. It stated that references to the potential encountering of oil should be reviewed and revised as necessary so as to not prohibit Usibelli from seeking a determination from ADEC and AOGCC in this regard, as stated on page 1-25.

ADNR Response: Pursuant to regulations administered by ADEC, AOGCC must determine that evidence obtained through evaluation of exploration data demonstrates with reasonable certainty that the exploration wells will not penetrate a formation capable of flowing oil to the ground surface. If that determination is made, gas wells are exempt from any requirement for an Oil Discharge prevention and Contingency Plan (C-Plan). If that determination cannot be made, the licensee must comply with the requirements of AS 46.04.010 - .900, including the preparation and approval by ADEC of a C-Plan and other requirements under AS 46.04.

Comment Summary: Usibelli stated that UCM operates an ADEC permitted solid waste landfill. The restriction to only use a MSWL for non-drilling waste is inappropriate if another solid waste landfill is approved and available for receiving the material.

ADNR Response: The mitigation measures do not prohibit use of existing ADEC permitted solid waste landfills for non-drilling waste.

Comment Summary: Usibelli stated that the Helm (1985) vegetation study from UCM's Poker Flat's permit is only one of numerous environmental baseline studies contained in UCM's surface mining permits. Usibelli stated that these permits contain extensive public information on topics such as pre-mining soils, ground water, surface water, vegetation, wildlife, archeology and cover significant portions of the license area, and that an environmental impact statement was issued in 1998 and a best interest finding in 1999 for Golden Valley Electric Association's Northern Intertie project. Usibelli stated that an EIS was completed in 1993 for the Healy Clean Coal Project and the Tanana Basin Area Plan also contains significant information on the license area, and that this information should be referenced in Chapter Three and acknowledged as existing information to be utilized in future permitting.

ADNR Response: This information has been added to Chapter Four.

Comment Summary: Usibelli stated that it is unclear if the raptor information attributed to McIntyre by personal communication is documented or available to UCM and the public in written form, and whether the information is from the Healy Basin or from Denali National Park and Preserve. Usibelli stated that it would prefer undocumented citations to license area wildlife populations be removed from the final best interest finding.

ADNR Response: The information provided by McIntyre was for the Healy Basin. All references used in developing the finding are part of the administrative record and are available to the public. The director is required to consider and discuss "facts that are known to the director", that are "within the scope of the administrative review established by the director" (AS 38.05.035(g)(1)(A)), and that are material to items listed in AS 38.05.035(g)(1)(B). Personal communications may be appropriate for consideration when they come from experts or other credible sources and contain material information. Unpublished data or information may also be material to the finding.

Comment Summary: Usibelli stated that the Tanana Basin Area Plan clearly designates the license area as multiple use, with the majority of it designated for mineral development and all of the area open for oil and gas leasing.

ADNR Response: Information on Tanana Basin Area Plan has been included in the final finding. The Tanana Basin Area Plan allows oil and gas leasing throughout the Tanana Basin.

Comment Summary: Usibelli stated that the discussion of CBM in Chapter Five seems out of date. Usibelli stated that although CBM in Alaska is relatively new, CBM has been commercially produced for approximately three decades in the lower 48; that CBM accounts for 9% of the U.S. dry natural gas production and 10% of the U.S. natural gas reserves according to DOE. Usibelli stated that although CBM efforts in the state may lag those of the lower 48, extensive literature on CBM exploration and development exists that should be utilized by the state to keep abreast of CBM matters in the U.S.

ADNR Response: The discussion of coalbed methane has been updated. However, the license includes both conventional gas and coalbed methane. See response to Common Issue 11.

Comment Summary: Usibelli stated that it is unclear what jobs have been attributed to local government because the numbers in Table 5:4 appear far too high.

ADNR Response: The information in the final finding is from the current DOLWD web site and is now in Chapter Three.

Comment Summary: Usibelli stated that the comments on the finances and status of Healy Clean Coal Power Plant seem out of place in Chapter Five (Chapter Eight in the final finding) and are not relevant to the license. See prior comment regarding the need for additional discussion on the extensive existing infrastructure and electricity available in the area.

ADNR Response: Basic information about the Healy Clean Coal Power Plant is relevant to describing the area and is found in Chapter Three of the final finding.

Comment Summary: Usibelli stated that summer exploration activities, including seismic work, should not be restricted and should be allowed on a case-by-case basis. Usibelli stated that much of the area has extensive pre-existing road and trail systems and is well-drained foothills terrain where summer travel over the surface can be done with minimal or temporary impacts to the surface; and that because of the steep terrain, temporary roads are sometimes required to access exploration sites and summer construction of those roads may be much safer, more cost-effective, and provide summer employment opportunities for local residents and students.

ADNR Response: Mitigation measures allow exploration using existing road systems and off-road vehicles that do not cause significant damage to the ground surface or vegetation, and construction of temporary roads may be allowed.

Comment Summary: Usibelli stated that the reference on p. 5-29 in the preliminary finding to Dall sheep critical habitat existing above 2,000 ft in the eastern portion of the license area appears inconsistent with the shaded area of Figure 3.5, which shows the general distribution of Dall sheep habitat in the license area.

ADNR Response: Figure 3.5 was mislabeled as Dall sheep "habitat" in the preliminary finding. The correct caption should be Dall sheep "distribution". The map does not show critical habitat.

Comment Summary: Usibelli stated that it appears that ADNR's December 2004 Enforceable Standards for CBM Development in the Mat-Su Borough have been largely incorporated into the preliminary best interest finding with little or no meaningful modification. Usibelli stated that when it commented on the Mat-Su project, ADNR stated the Mat-Su standards "will only apply within the Mat-Su. If CBM is pursued outside the Mat-Su, then ADNR will pursue standards in that area at that time. Eventually, if CBM is pursued in a number of areas of the state, ADNR may consider proposing standards similar to these as regulations, and conduct a statewide regulations development process." Usibelli stated that it found DO&G's blanket adoption of the Mat-Su CBM standards in the Healy Basin to be inconsistent with its previous stated intent and application in other areas of the state.

Usibelli also stated that it is also unclear whether the standards apply only to CBM wells or apply also to conventional gas wells. Usibelli stated that DO&G specifically stated in numerous comment responses to the Mat-Su standards that they were intended to apply to CBM activities only. Usibelli stated that it is also unclear in many instances whether the standards only apply to areas in close proximity to residential areas, or apply over the entire license area, and that these concerns apply particularly to several of the proposed mitigation measures under the Facilities and Operations and Water Management sections relating to set-backs, visual impacts, noise impacts, and monitoring plans.

Usibelli stated that it does not agree that each of the mitigation measures identified in the preliminary best interest finding is necessary, and that the operational practicalities and economics would be significantly affected if ADNR were to impose any more onerous mitigating measures.

Usibelli stated that the best interest finding and mitigation measures should be revised to address these inconsistencies by specifically restricting their applicability to CBM wells only and to only the portion(s) of the license area containing residential areas.

ADNR Response: Mitigation measures in the final finding apply to natural gas in general and do not distinguish between coalbed methane and natural gas in general. Final mitigation measures for the Healy exploration license have been modified as necessary after considering comments received during the public comment period.

Comment Summary: Usibelli stated that DO&G's definition of "permanent facilities" in Chapter Seven appears to be any structure left in place for more than six months and includes well casing. Usibelli requested clarification on this issue and on how potential conflicts might be addressed with the requirements to case CBM wells and/or operate tests for more than six months.

ADNR Response: The definition of "permanent facilities" has been amended in the final finding to exclude exploration wells.

Comment Summary: Usibelli requested that DO&G reconsider and revise the ½ mile prohibition of siting temporary or permanent facilities other than docks, roads, utility and pipeline crossings from the banks of the Nenana River. Usibelli stated that this measure appears arbitrary as no meaningful discussion exists in the preliminary best interest finding citing the justification for this measure in addition to the other setbacks and measures.

Usibelli stated that the Nenana River corridor has been utilized as a commercial transportation corridor throughout the license area's history, and that there are numerous permanent residential, commercial and industrial facilities along the river that have not resulted in any ill effects on the river. Usibelli stated that its own permanent facilities, that have been the stated initial potential market for any gas discovered, exist within this setback, as do Usibelli's access roads on both sides of the river, and that it is unreasonable for DO&G to hold activities in the license area to a different standard than other state-approved projects and facilities historically approved and currently operating in, and adjacent to, the license area.

Usibelli stated that the ½ mile setback also appears inconsistent with the measures included in the Nenana Basin best interest finding issued immediately to the north of the Healy Basin and in the Holitna preliminary best interest finding that was concurrently under consideration. Both of these documents require a ¼ mile setback.

Usibelli stated that the consolidation of any new facilities under the license into existing commercial developments and rights of way would create the least disturbance and make the most environmental and economic sense, and that the mitigation measure as written would force development on less suitable and currently undisturbed sites and unreasonably condemns a significant portion of the license area and prospective shallow gas and CBM prospects.

ADNR Response: Facilities may be sited within these buffers if the licensee demonstrates to the satisfaction of the Director, in consultation with ADF&G, that site locations outside these buffers are not practicable or that a location inside the buffer is environmentally preferred.

The setback from the Nenana River has been adjusted to allow for a shorter distance in areas that are classified by land use plans as areas for industrial use, or where established usage and use history show industrial or commercial use.

Comment Summary: Usibelli stated that the term "temporary" included in the ½ mile setback measure is inconsistent with the "permanent" facilities language cited elsewhere in the preliminary best interest finding and is assumed to be a typographical error.

ADNR Response: It is not a typographical error. *Temporary* and *permanent* facilities will be prohibited within ½ mile of the Nenana and Savage rivers *unless* the director determines in consultation with ADF&G, that site locations outside these buffers are not practicable or that a location inside the buffer is environmentally preferred. See response to previous comment.

Comment Summary: Usibelli stated that there does not appear to be any weighting for economic considerations in reviewing exceptions to the ½ mile setback measure, and that therefore, a determination of an equal impact, but lower cost, does not appear to meet the very restrictive criteria and test.

ADNR Response: Exceptions may be granted if it is not practicable to comply with the standard. The final finding uses the term practicable instead of "feasible or prudent". Practicable means feasible in light of overall project purposes after considering cost, existing technology, and logistics of compliance with the mitigation measure.

Comment Summary: Usibelli stated that the visual mitigation measures included in Chapter Seven of the preliminary finding are an example of standards specifically created by ADNR for CBM activities in high density residential areas within the Mat-Su Borough that appear to be applied in the Healy Basin over the entire license area regardless of, and without consideration to, land use or type of activity. Usibelli stated that Mitigation Measure 7.c.vi of the preliminary finding does not appear to contemplate basic paint schemes for safety concerns, particularly in areas open to hunting.

ADNR Response: Similar visual standards have been included in other oil and gas sale areas and exploration license areas when local residents or other users of the area are particularly concerned about such issues. The mitigation measures suggest basic paint schemes that may be required to decrease visual impacts of facilities; where safety concerns suggest a different paint scheme would be prudent, that may be determined on a case-by-case basis.

Comment Summary: Usibelli stated that the noise standards appear arbitrary and possibly unreasonable because no discussion or citations were provided in the preliminary best interest finding relating to the source and justification for the specific attainment standards; also, there is no discussion about what portions of the license area, or type of activities, would require a monitoring plan.

ADNR Response: The noise standards have been rewritten for the final finding. Specific noise criteria and methods to meet those criteria will vary depending on location and will be determined on a case-by-case basis during the permitting process.

Comment Summary: Usibelli stated that the setback requirements of 500 ft and 1,500 ft from residential structures are prohibitive and that circular areas of radius 500 ft and 1,500 ft encompass 18 acres and 162 acres respectively. Usibelli stated that these setbacks give a landowner the power to dictate to an adjacent landowner(s) whether or not development on his property can take place, regardless of possible consent and the noise, visual and groundwater protection measures already included. Usibelli stated that the setback on compressors includes no consideration for unit size, type or technology and could severely restrict development, and that there is no reference in this measure for it only being applied to CBM activities, regardless of its origin from the Mat-Su standards.

ADNR Response: Mitigation Measure A(1)(a) and Mitigation Measure A(1)(b) balance concerns of residents with needs of development.

Comment Summary: Usibelli stated that the requirement to obtain approval from all surface property owners within a subdivision, to operate on any lot in the subdivision, goes beyond reasonable regulation and/or typical zoning requirements and possibly constitutes a taking action of individual owner's rights. This type of measure should not be necessary on top of the additional setbacks and other protective measures that are included. At most, the restriction should be reduced to obtaining the approval of the surface owners "adjacent to" a subdivision lot on which CBM operations are proposed.

ADNR Response: The requirement for obtaining consent of all surface property owners within a subdivision has been removed from mitigation measures in the final finding.

Comment Summary: Usibelli stated that the rugged terrain of much of the upland foothills portion of the license area largely restricts travel to ridge-top roads and trails. The ½ mile restriction on mobile activities from bear dens could encompass multiple drainages and is not appropriate for the

Healy Basin area. The requirement to obtain approval of the Director and ADF&G for exceptions to this setback should be reviewed and revised.

ADNR Response: Mitigation measures regarding bears have been modified in the final finding, and are consistent with mitigation measures in other areas of Alaska and for other leases and licenses. Alternative measures may be approved in the bear-human interaction plan.

Comment Summary: Usibelli stated that on-site cuttings and mud disposal should be allowed where non-toxic drilling mud is used; that shallow drilling may eliminate the need to use chemicals for drilling mud conditioning, and simple mineral additives to increase mud weight can be disposed of in reserve pits, covered and reclaimed to provide permanent and safe disposal; and that the possibility for encountering subsurface oil and liquids that might further contaminate cuttings is very remote.

ADNR Response: Injection of non-hazardous oilfield wastes is regulated by AOGCC. Drilling waste disposal is specifically regulated under 18 AAC 60.430.

Comment Summary: Usibelli stated that it reserves whatever rights it may have to submit additional material and otherwise address any changes made by ADNR to the draft license agreement, and specifically on the incomplete terms in Items 2 and 4, until such changes can be reviewed by Usibelli; and that Usibelli assumes the definition of "gas" includes natural gas liquids.

ADNR Response: Comment noted. The exploration license and conversion license provided in Appendices C and D are examples only.

Comment Summary: Usibelli stated that the preliminary best interest finding does not give adequate credit for the potential statewide benefits of successful gas development in the Healy Basin; that by ADNR's own account, Alaska's hypothetical coal resources exceed 5.5 trillion short tons and may contain up to 1,000 TCF of gas. Usibelli stated that restricting the discussion of effects to a relative basis, versus the established oil and gas production and revenues of the state, would seem to always yield a modest determination of effects for any new area or type of development, and that the downstream effects of the possible successful development of shallow gas and CBM resources in the Healy Basin would likely have a large positive impact on the potential development of the state's multiple sedimentary basins that could provide additional energy sources to both small rural and larger urban Alaskan communities. Usibelli stated that this potential long term value to the state and local communities, of developing enhanced CBM technology and expertise within the Alaska workforce and regulatory agencies, could clearly extend to the possible development of CBM in other areas of the state.

ADNR Response: Comment acknowledged. Chapter Eight, Section G(1) discusses potential fiscal effects on Alaska and states, "The potential availability of natural gas on the road system could have a positive impact beyond the value of royalty income to the state." In addition, a paragraph on the benefits of the state receiving subsurface geologic information has been added to Chapter Six, Section B of the final finding.

C. Other Representative Comments from Individuals

Timely comments were received from 58 individuals (Table A.2). One additional individual submitted written comments but did not provide a name. Written comments were received from three individuals (David W. Jacobs, Lorinda Lhotka, and Jeff Wysong) after the comment deadline of October 31, 2005. During the public hearing, oral testimony was given by 17 people (Table A.3), some of whom also submitted written comments. This section provides summaries of comments that are representative of comments received from individuals.

Table A.2. Individuals who submitted comments on the preliminary finding.

Name	Location	Name	Location
Amanda Austin and Tom Wappel	Healy, AK	Elwood Lynn	Healy, AK
Jean Balay	Healy, AK	Amanda J. McCaleb	
Charles Bale	Healy, AK	Linda Mellman	Denali Park, AK
Andrea J. Blakesley		Jon M. Nierenberg	Healy, AK
David Braun	Healy, AK	Patricia Nordmark	Healy, AK
Susan S. Braun	Healy, AK	Eric Oberg	
Barbara Brease	Healy, AK	Kelly Oberg	Healy, AK
Meg Burgett		Gloria Oswald	Denali Park, AK
Dr. Amy Clary	Denali Park, AK	Patricia Owen	Denali Park, AK
Wallace and Jerryne Cole	Denali Park, AK	Jon and Anni Podkonyak	
Ruth and Dominic Colianni	Denali Park, AK	Phyllis and Harry Rassigner	
John Crowley	Renton, WA	Charlie and Ilah Reynar	Denali Park, AK
Steve Denton	Healy, AK	Eric Sather	Healy, AK
Nan Eagleson	Denali Park, AK	Paul Schenk	Anderson, AK
William and Linda Forsberg	Healy, AK	David Schirokauer	Olema, CA
Karen Fortier	Healy, AK	Bob Shelton	Denali Park, AK
James S. Graham		Al Smith	Healy, AK
Simon Hamm	Denali Park, AK	Toby Smith	Denali Park, AK
Dulce Havill	Denali Park, AK	Pamela Sousanes	Healy, AK
Matt Irinaga and Paula Earp		Mike Speaks	
Jenasy Y. Jensen	Healy, AK	Jan St. Peters	Healy, AK
Kenneth F. Karle	Denali Park, AK	Chuck Tomkiewicz	Healy, AK
Frank Keim	Fairbanks, AK	H. Keith Walters	Healy, AK
Chuck Klemer	Denali Park, AK	James Walton and Larissa Yocum	Denali Park, AK
Norm Kloster	Healy, AK	Richard N. Weibel	Healy, AK
Roberta Koppenberg	Cantwell, AK	Lyle Westphal	Healy, AK
Eli Kramer	Healy, AK	Naomi Whitty	
Paul Lhotka	Fairbanks, AK	Grady Wilson	Healy, AK
Charlie Loeb	Denali Park, AK	Jennifer S. Wolk	Denali Park, AK

Table A.3. Individuals who provided oral testimony during the public hearing.

Name	Name	Name
Jean Baily	Sue Dey	Leanne Stone
Mary Lou Baily	Bill Freezen	Jan St. Peters
William Baily	Jenna Hamm	Chuck Tomcuwicz
David Braun	Charlie Loeb	David Tomeo
Susan Braun	Mel Lynn	Grady Wilson
Barbara Brease	Eric Oberg	

1. Bale, Charles

Healy, AK. Letter of September 17, 2005

Comment Summary: Mr. Bale stated that the Healy exploration license is not in the best interests of the residents or recreational users or hunters.

ADNR Response: Opposition noted.

Comment Summary: Mr. Bale stated that Panguingue Creek Subdivision is not listed as a community, despite its having a home owners association, and that he objects to any drilling in or adjacent to the subdivision.

ADNR Response: Communities defined by the Department of Commerce, Community, and Economic Development, Division of Community and Regional Affairs are listed in the finding. Private land owners in the subdivision are afforded the same protections as landowners in other Denali Borough communities. See Common Issues 1 and 10.

Comment Summary: Mr. Bale stated that the standards and regulations, if implemented, will effectively destroy the homes of local residents and any land value upon which they are depending for retirement needs. The standards and regulations are similar to the enclosure laws of 16th century England, which reduced free yeomanry to penury by giving the commons to the rich who were engaged in wool production.

ADNR Response: See Common Issue 1.

Comment Summary: Mr. Bale stated that there appears to be no meaningful public process.

ADNR Response: There was an extensive public process, including public meetings, public notice, and review of the preliminary best interest finding. The public process required by AS 38.05.035(e) and AS 38.05.945 was followed.

2. Braun, David

Healy, AK. Letter of October 31, 2005

Comment Summary: Mr. Braun stated that industrial development of this type is incompatible with the commercial and residential development that is vital to the local economy. He stated that Healy is a gateway community for Denali National Park, and that local tourism depends on natural land, unobstructed views, wildlife, scenic beauty, and quiet surroundings. He stated that presently, the local government depends almost exclusively on bed taxes, and that if industrial gas development is allowed, the area will be a less attractive destination.

ADNR Response: See response to Common Issue 2.

Comment Summary: Mr. Braun stated that this development violates local residents' property rights, that the local government has reneged on its statutory requirement to provide for land use regulation, and that ADNR, which as the authority to zone land throughout the state, has not exercised that authority, and has intentionally ignored its own land use plans, notably the Tanana Basin Area Plan (TBAP), which states that the Stampede area is critical wildlife habitat.

ADNR Response: The TBAP allows oil and gas leasing throughout the Tanana Basin. The TBAP defers any decisions regarding leasing for oil and gas and other energy resources to ADNR's existing leasing processes, under which this best interest finding was developed.

Comment Summary: Mr. Braun stated that it has been estimated that property values will decrease by 20% if CBM occurs in the areas now planned, and that surface property rights would be meaningless. He stated that it will not be possible to legally keep drilling rigs, roads, light plants, and compressors off of private property. He stated that the negative effects of this type of development are well expressed in the preliminary best interest finding, which states, "The best interests of local residents is therefore of critical importance to the best interest decision".

ADNR Response: See responses to Common Issues 1, 10, and 12.

Comment Summary: Mr. Braun stated that he attended the public hearing in Healy and agrees with his neighbors who oppose drilling in the Healy area, and that no one spoke in favor of gas development west of the Nenana River.

ADNR Response: Opposition noted. See response to Common Issue 7.

Comment Summary: He stated that the mitigation measure allowing gas development in subdivisions with lots greater than five acres was specifically tailored to allow gas development in Panguingue Subdivision.

ADNR Response: This mitigation measure has been removed and replaced with a general setback, with exceptions, for drill pads (500 ft) and compressor stations (1,500 ft) from an occupied building (Mitigation Measure A(1)(b)(i)).

Comment Summary: He stated that the benefits of gas development west of the Nenana River are speculative at best, and that it is questionable whether there will be a net gain of jobs in the area, and that there could be a net loss. He stated that at the public comment meeting, Mitch Usibelli confirmed that there would likely be no cheap energy available for local consumption as a result of gas development.

ADNR Response: See response to Common Issues 5 and 7.

3. Hamm, Jenna

Healy Meeting. October 10, 2005

Comment Summary: Ms. Hamm stated that the livelihood of local residents depends on the ecological integrity of Denali and the continued protection of its wildlife, that the best interest finding inadequately addressed wildlife and critical habitat that exist within the license area, and that the proposed mitigation efforts are inadequate.

ADNR Response: Mitigation measures in the final finding, combined with evaluation and approval authority for all plans of operation, will provide protection against potential negative effects. ADNR may also impose additional conditions on approvals of plans of operation when specific activities in specific locations have been proposed.

Comment Summary: Ms. Hamm stated that the western part of the license area is frequently used in the winter by the Denali Caribou Herd, which currently numbers about 1,300 caribou; that this area, especially the eastern portion, appears to be critical habitat but little is proposed to protect it; and that the finding that exploration for CBM is in the best interest anywhere west of the Nenana River should be reversed.

ADNR Response: See response to Common Issues 7 and 8.

Comment Summary: Ms. Hamm stated that tourism is the lifeblood of the Denali Borough, that the animals of the Denali Caribou Herd are viewed by approximately 300,000 visitors each year, likely representing the most watched caribou in North America and perhaps the world.

ADNR Response: See response to Common Issue 2.

Comment Summary: Ms. Hamm stated that the provision that detonation of explosives must not produce pressure changes greater than 2.7 psi in the swim bladders of fish will be difficult to monitor, and that instead, ADNR should mandate that detonation not occur within 400 or 500 ft of fish-bearing waterbodies.

ADNR Response: Mitigation Measure A(2)(a) directs the licensee to blasting standards that are available from ADF&G. These standards provide setbacks given topographic condition, substrate material, and explosive charge weights, and can be found at: http://www.habitat.adfg.alaska.gov/tech_reports/standards_techniques/akdofg%20blasting%20standards.pdf .

4. Jensen, Jenasy

Healy, AK. Letter of October 31, 2005

Comment Summary: Ms. Jensen stated that her primary concerns are water quality and quantity, increased noise level, increased traffic, and safety issues.

ADNR Response: See response to Common Issues 2, 3, and 6. Mitigation Measure A(1)(iv) requires that a plan of operations include an emergency preparedness and response plan.

Comment Summary: Ms. Jensen stated that since the Denali Borough Assembly has recommended that exploration be confined to the east side of the Nenana River, how that will affect the community of Ferry should be carefully examined because Ferry is the only active community on the east side of the river.

ADNR Response: See Common Issues 1, 7, and 10. Land owners on both sides of the river are afforded the same protections found in Mitigation measures A(1)(a) and A(1)(b).

Comment Summary: Ms. Jensen stated that setbacks around the Ferry area should be increased.

ADNR Response: Mitigation Measure A(1)d) establishes setbacks from the Nenana River, except in areas classified for industrial use or where established usage and history show industrial use. Mitigation Measure A(1)(b)(i) requires that drill pads be constructed at least 500 ft and compressor stations at least 1,500 ft from any occupied residential structure, community or institutional building. These setbacks are sufficient to protect fish and wildlife habitats and populations and other uses and values of the license area.

Comment Summary: Ms. Jensen requested that a written notice be sent to the Ferry Community Corporation regarding all future actions that will impact the community.

ADNR Response: The Ferry Community Corporation has been added to DO&G's mailing list and will receive all public notices regarding this project in the future.

5. Karle, Kenneth

Denali Park, AK. Letter of October 31, 2005

Comment Summary: Mr. Karle stated that the finding is very inadequate in providing explanations and details as to the proposed action for a number of subjects, particularly regarding water issues, and that the mitigation measures and techniques are very inadequate.

He stated that the greatest impacts to the environment and the people who live in the area from CBM production are likely to be impacts to groundwater and surface waterbodies, including drawdown of local aquifers, continuous disposal of excessive amounts of produced water, and water quality degradation. He stated that all of these topics are very complex, but that the mitigation measures listed in Chapter Seven are too abbreviated and non-specific.

ADNR Response: See response to Common Issue 3 and Chapter Eight. Complexities of water-related issues are addressed in many state and federal laws and regulations. These laws and regulations are referenced in the finding, but an exhaustive list is not provided. However, the licensee is subject to, must comply with, and implement all applicable local, state, and federal laws and regulations.

Comment Summary: Mr. Karle stated that other mitigation measures should be added, including the need for the licensee to hire an independent qualified licensed professional engineer specifically with long-term experience in groundwater studies and numerical modeling to do monitoring.

ADNR Response: A plan of operations application must include a water quality monitoring plan. (see Licensee Advisory B(2)(a)). Under AS 31.05.030(j)(2)(D), AOGCC requires the operator of a coalbed methane well to design and implement a water well testing program to provide baseline data on water quality and quantity, and make the results available to the public.

Comment Summary: Mr. Karle stated that at this stage of the planning and permit acquisition process, the licensee should have identified a preferred method for water disposal, and that the best interest finding is inadequate when discussing the disposal of large quantities of water produced during the exploration and production phases of this project.

ADNR Response: This finding addresses the exploration license phase; other subsequent phases will be addressed by permitting and in plans of operations. See response to Common Issue 3. The licensee must comply with all applicable local, state, and federal laws and regulations, such as those listed in Licensee Advisories B(4)(a-d). Surface disposal of produced water will not be allowed unless ADEC determines that the discharge will meet state water quality standards and the director has approved the water management plan (Mitigation Measure A(1)(a)(vii)).

Comment Summary: Mr. Karle requested that populated areas west of the Nenana be removed from the exploration license area.

ADNR Response: See response to Common Issue 7.

Comment Summary: Mr. Karle stated that the best interest finding failed to note how exploration and development of a well field within the settled and populated area of the town of Healy would meet the best interests of the residents of Alaska. He stated that he removal of the populated areas west of the Nenana River from the exploration license area would still leave a large area to explore and develop, and would not affect the best interests of Alaska and Alaskans.

ADNR Response: See response to Common Issue 7.

6. Kloster, Normal

Healy AK. Letter of October 27, 2005

Comment Summary: Mr. Kloster stated that he strongly opposes any drilling for CBM in any of the areas west of the Nenana River in the Healy/Lignite area, and that all CBM drilling should be limited to the east side of the Nenana River.

ADNR Response: See responses to Common Issues 7 and 11.

7. Lhotka, Paul

Fairbanks, AK. Letter of October 31, 2005

Comment Summary: Mr. Lhotka stated that he is an owner of a remote recreational homestead in the Rock Creek area west of Ferry, and that he opposes CBM exploration or development in the area. He stated that the Ridge Rock area has been designated as a remote recreational homestead area, and that the impacts of commercial or industrial development in the area will detract from its original intent as a recreational residential area. He stated that he also opposes any development from the Stampede area north to Ridge Rock, and he requested that ADNR explore alternatives, such as development east of the Nenana River.

ADNR Response: Opposition noted. The TBAP allows oil and gas leasing throughout the Tanana Basin. See responses to Common Issues 1, 2, 7, 10, and 11.

8. Loeb, Charlie

Healy Meeting. October 10, 2005

Comment Summary: Mr. Loeb stated that he is glad that UCM applied for the exploration license, that UCM has always been a great friend to the community, and is a great contributor to most everything that goes on in Healy.

ADNR Response: Comment acknowledged.

Comment Summary: Mr. Loeb stated that a study from LaPlata County, Colorado, located in the Durango area which has great natural beauty like the Healy area, found that property values were 22% lower if a gas well was located on the property, relative to comparable properties. He stated that the 22% loss in property values would be only a fraction of what Healy property owners would lose.

ADNR Response: See response to Common Issue 1.

Comment Summary: Mr. Loeb stated that he read a quote from a Wyoming landowner affected by nearby CBM development describing the loud noise generated by a large nearby compressor station, that the noise was so loud that the dog was too frightened to go outside, and that the noise was like that of a circling jet plane 24 hours a day. He stated that noise that is that constant will drive people to the breaking point.

ADNR Response: See response to Common Issue 6.

Comment Summary: Mr. Loeb stated that all of the negative impacts of CBM development may not occur in the Healy area because there is the potential to learn from other locations such as Wyoming and Colorado.

ADNR Response: Comment acknowledged. ADNR has researched and visited CBM development sites in Colorado and Wyoming and finds that the development and leasing statutes are significantly different. Alaska's are more protective of environmental and surface owner interests.

Comment Summary: Mr. Loeb stated that CBM development will industrialize the rural landscape of the Healy area, that CBM is essentially a disbursed industrial development, that the benefits are essentially undocumented, and but that the potential benefits to local residents are unclear.

ADNR Response: ADNR considered the comments from local residents and, in this final finding, addresses the relevant concerns raised. In making a best interest finding, the director must balance environmental protection with development to ensure that multiple uses can occur on state lands and that oil and gas development is compatible with other uses such as recreation. This is accomplished through the imposition of mitigation measures, which are listed in Chapter Nine. In addition, the licensee is required to comply with all applicable federal, state, and local laws and regulations. See also response to Common Issue 11.

Comment Summary: Mr. Loeb stated that there are opportunities for participating in the development of the plan of operations, but that requires significant time and energy for local residents to continue participating in over the long term. He stated that he has had to take time off from his family to attend the hearing, and that he does not want to have to go through a similar process year after year working on the CBM issue.

ADNR Response: ADNR is required by Alaska law to solicit public input at each phase of development (AS 38.05.035(e)).

Comment Summary: Mr. Loeb stated that ADNR and UCM should acknowledge that granting the exploration license is not in the best interest of local residents or the state, especially those areas that are primarily west of the Nenana River.

ADNR Response: Comment acknowledged. See response to Common Issue 7.

9. Oberg, Eric

Healy Meeting. October 10, 2005

Comment Summary: Mr. Oberg stated that the subdivision rule in place in the preliminary finding is inadequate and does not protect residential subdivisions in the license area. He stated that most parcels are small, but many are larger than five acres, even though they do not differ in character from the five acre or less parcels. He stated that an example of this is Panguinie, for which only 71 of the 196 parcels (36%) are less than five acres, but for which 159 of 196 (81%) are less than six acres; thus the definition of a subdivision where gas exploration is allowed is changed by only one acre.

ADNR Response: This mitigation measure has been removed and replaced with a general setback, with exceptions, for drill pads (500 ft) and compressor stations (1,500 ft) from an occupied building (Mitigation Measure A(1)(b)(i)).

Comment Summary: Mr. Oberg stated that the vegetation in the Healy area, as opposed to the Matanuska-Susitna, is low tundra, that there are not many trees or hills to provide natural buffers to the sounds of compressor stations, that one of the mitigation measures is to place infrastructure behind hills, trees, and stands, but that these features are lacking in the Healy area.

ADNR Response: Mitigation Measures A(1)(b)(ii) and (iii) include many options to reduce visual and noise impacts. See response to Common Issue 6.

Comment Summary: Mr. Oberg stated that because of the extensive public land ownership, it should not be necessary for the licensee to enter onto private land for exploration or development, and that the state should be very conservative in allowing surface entry over the objection of owners. He requested that no drill pads or compressor stations be permitted in any primary residential or recreational subdivision where the majority of the lots are ten acres or less without the consent of all land owners in the subdivision, and that no drill pads or compressor stations be allowed on any parcel twenty acres or less, without the consent of the land owners.

ADNR Response: See response to Common Issue 10. See previous response regarding setbacks.

Comment Summary: Mr. Oberg stated that he had heard that many of the Mat-Su mitigation measures were included in the Healy best interest finding, and that the ordinance passed for the Mat-Su with a setback of 1,340 ft is the strictest ordinance in the country. He stated that the setback of 500 ft in the preliminary finding is much less, and requested that the setback for the Healy area be set at the distance of the Mat-Su setback ordinance.

ADNR Response: Many of the Mat-Su enforceable standards for development of CBM (adopted in December 2004) were incorporated into the Healy best interest finding. Mitigation Measure A(1)(b)(i) requires setbacks of at least 500 ft from any residential structure for drill pads and at least 1,500 ft for compressor stations. An exception may be granted if the operator obtains the consent of the owner of the residential structure, or demonstrates that the drill pad and/or compressor station will be substantially hidden from view, and that the noise levels experienced will not exceed ambient noise levels. This is identical to the Mat-Su enforceable standards.

Comment Summary: Mr. Oberg stated that local residential areas currently enjoy a fairly quiet setting, and that most residents place high value on this quality. He stated that the noise limits proposed in the best interest finding are similar to noise limits published for the city of Seattle for noise ordinances allowed in residential areas that border industrial areas. He stated that this is inadequate noise mitigation for a rural area in Alaska, and that living near sounds similar to the industrial area of Seattle is unacceptable.

ADNR Response: See response to Common Issue 6.

Comment Summary: Mr. Oberg stated that serious air quality problems have resulted from equipment emissions in other parts of the country where CBM development has taken place, and that although the best interest finding requires emissions to remain within state and federal standards, this would still represent a steep decline from current excellent air quality that characterizes the Healy area.

ADNR Response: See response to Common Issue 4.

Comment Summary: Mr. Oberg stated that water disposal is not adequately discussed, that surface disposal remains an option, and that decisions are deferred to the plan of operations phase. He stated that in Wyoming's Powder River Basin, companies have constructed huge impoundments to hold waste water, and that reinjection should be required. He also stated that local wells are being undersold, and that although monitoring is mentioned, it is unclear what will happen if monitoring shows significant damage or pollution.

ADNR Response: See response to Common Issue 3 and 11. ADNR has researched and visited CBM development sites in Colorado and Wyoming and finds that the development and leasing statutes are significantly different. Alaska's are more protective of environmental and surface owner interests.

Comment Summary: Mr. Oberg stated it is not in the best interest of local residents and most other land owners in the borough for there to be any gas exploration or development under settled lands, at least west of the Nenana River.

ADNR Response: Opposition noted. As for development west of the Nenana River, see response to Common Issue 7.

10. Smith, Al

Healy, AK. Letter of October 26, 2005

Comment Summary: Mr. Smith stated that he has had a cabin in Ferry since 1990, and that it is neither wise nor fair to grant leases for this kind of resource extraction in residential areas. He stated that the record from the lower 48 shows that there is too high a potential for contamination of groundwater for this project to be appropriate near residential areas, and that surface and noise impacts are also a concern.

ADNR Response: Opposition noted. See responses to Common Issues 3, 6, and 10. ADNR has researched and visited coalbed methane development sites in Colorado and Wyoming and finds that the development and leasing statutes are significantly different. Alaska's are more protective of environmental and surface owner interests. See also response to Common Issue 11.

Comment Summary: Mr. Smith stated that the Denali Borough has excluded the homes on the west side of the Nenana River from this development;, but it is unclear why homes in Ferry are given less consideration. He requested that the same residential nature of the community of Ferry be acknowledged and be treated as other Denali Borough residential zones when granting these leases.

ADNR Response: See response to Common Issue 7. Lands west of the Nenana River are included in the license area. The Denali Borough has adopted regulations requiring that gas exploration facilities be set back from a recorded private property line (9 DBC 25.010). Drill pads must be set back 500 ft and compressor stations 1,500 ft. Variances are allowed if the operator obtains written consent of the landowner(s) adjoining the setback. Approval is also required from the Denali Borough. In addition, at least one public hearing must be held prior to securing a variance. This applies to lands on both sides of the river.

11. Stone, Leanne

Healy Meeting. October 10, 2005

Comment Summary: Ms. Stone stated that health repercussions for people in the community have not been addressed, that fumes occur, and that there are concerns for people with allergies.

ADNR Response: See response to Common Issue 4.

12. St. Peters, Jan

Healy, AK. Letter of October 31, 2005

Comment Summary: Ms. St. Peters stated that there was no one in favor of the license at the Healy meeting, which is significant because the best interest finding states, "the best interests of local residents is therefore a critical importance to the best interest decision." She stated that even if gas is found, there will be minimal financial benefit to the State of Alaska, and therefore the exploration license is not in the best interests of the people of the State of Alaska.

ADNR Response: See response to Common Issue 12.

Comment Summary: Ms. St. Peters stated that Mitch Usibelli said that if gas is found and could be developed, it would not generally benefit the local community in terms of lowered energy costs and that it would be of primary benefit to the mine itself.

Response: See response to Common Issue 5.

Comment Summary: Ms. St. Peters stated that the process for commenting on the finding was flawed because only one opportunity to comment on the license was provided. She stated that

information on which the decision was based was limited, other than the general negative impacts of CBM development in other parts of the country.

ADNR Response: There has been an extensive public process, including public meetings, public notice, and review of the preliminary best interest finding. AS 38.05.035(e) and 38.05.945, which address the public notice and review process for best interest findings and subsequent activities, were followed, and public participation is provided at each phase of activity. Issuance of a license does not authorize subsequent activity, and each phase brings opportunities for public comment.

Comment Summary: Ms. St. Peters stated that the preliminary finding of the director points to why the license should not be granted, but then concludes by supporting the granting of the license, which is not supported by the finding.

ADNR Response: In making a finding, the director considers the material facts as required under AS 38.05.035(g), and weighs the benefits of the exploration license, the potential effects of the license, and the mitigation measures to determine if granting the license is in the best interests of the state. Chapter Eight of the finding considers and weighs the potential positive and negative effects of the license.

Comment Summary: Ms. St. Peters stated that the license area is on the migration route for many bird species, and that the area is also an almost yearly calving area and habitat for sheep, wolves, linx, fox, bears, and even caribou.

ADNR Response: See response to Common Issue 8. Additional information has been added to Chapter Four on habitat, fish, and wildlife.

Comment Summary: Ms. St. Peters stated that environmental concerns also include the possibility of groundwater pollution and noise impacts to existing uses, problems with waste disposal, soil contamination, and loss of property values.

ADNR Response: See responses to Common Issue 1, 3, and 6.

Comment Summary: Ms. St. Peters stated that the proposed license will also negatively affect the tourism business.

ADNR Response: See response to Common Issue 2.

Comment Summary: Ms. St. Peters stated the license should be restricted to areas east of the Nenana River that are already disturbed by present and past mining activities.

ADNR Response: See response to Common Issue 7.

13. Tomeo, David

Healy Meeting. October 10, 2005

Comment Summary: Mr. Tomeo stated that he recognizes Usibelli's contributions to the community and its ability to be forthright. He stated that ADNR should work with the local people and the local government to create mitigation that works. He stated that the best interest finding states, "The best interests of the local residents are therefore of critical importance to the best interest decision."

ADNR Response: There has been an extensive public process, including public meetings, public notice, and review of the preliminary best interest finding. AS 38.05.035(e) and 38.05.945, which address the public notice and review process for best interest findings and subsequent activities, were followed. See also response to Common Issue 12.

Comment Summary: Mr. Tomeo stated that ADNR had described that if issues are brought up, they need to be defined, have measurable effects, and a significant impact. He stated that the same is

true of benefits to the local area. However, measurable significant impacts and benefits of the project are not clear, and there should be a cost benefit analysis that shows the license is in the community's best interest.

ADNR Response: Chapter Eight, Section G discusses fiscal effects on the state and local communities, and Chapter Eight, Section H discusses other potential effects such as jobs.

Comment Summary: Mr. Tomeo stated that there seems to be little understanding of the local area in the best interest finding, that the residents are dispersed, that it is a rural residential area, and that it is unlikely is it that gas will reach some of the local households.

ADNR Response: See response to Common Issue 5.

Comment Summary: Mr. Tomeo stated that road construction will increase access to the area, and that adding more roads and access will increase the number of sport hunters in the area.

ADNR Response: Under Mitigation Measure 2, exploration activities will utilize existing road systems and ice roads. Construction of temporary roads may be allowed. The State of Alaska, through the Boards of Fish and Game, has authority to restrict sport hunting if it determines that fish and wildlife populations are not sufficient for local subsistence needs.

Comment Summary: Mr. Tomeo stated that ADNR should look again at the impacts on ecotourism caused by a marred landscape.

ADNR Response: See response to Common Issue 2.

Comment Summary: Mr. Tomeo stated that exploration and development should be limited to the most promising area, whcih seems to be east of the Nenana River, and that by limiting the project to the east side of the river, local residents will be able to see what is occurring, and UCM and ADNR will know more about the project's prospects and how it will proceed.

ADNR Response: See response to Common Issue 7.

14. Westphal, Beth

Healy, AK. Letter of October 20, 2005

Comment Summary: Ms. Westphal stated that Otto Lake relies on spring melt run-off streams to renew its water levels and is a small sealed bottom lake, without a natural current to help replenish and cleanse its waters, and that if seasonal streams are diverted, disturbed or compromised with pollutants, Otto Lake will not recover.

ADNR Response: As explained in Chapter Nine, Section B, removal of water from fish-bearing water bodies is subject to the regulations for the Appropriation and Use of Water (11 AAC 93.035-.147) and ADF&G statutes AS 16.05.841 and AS 16.05.871. Surface disposal of produced water will not be allowed unless ADEC determines that the discharge will meet state water quality standards, and disposal of wastewater into freshwater bodies is prohibited unless authorized by NPDES or state permits. In addition, Mitigation Measure A(1)(a) requires a water management plan and approval by ADEC for surface disposal of produced water.

Comment Summary: Ms. Westphal stated that the area surrounding Otto Lake and Eight Mile Lake is inhabited by migratory birds, eagles, swans, ducks and geese that use the lakes every spring. She stated that loons, ducks and shorebirds next on Otto Lake and fox, hares, caribou (winter) and moose are frequent visitors, and that it is not uncommon to see an occasional brown or black bear. She stated that this critical habitat will be seriously compromised by industrial traffic, the introduction of chemical ground and air pollutants and noise pollution.

ADNR Response: See response to Common Issue 9. Mitigation Measures A(4)(e)-(h) protect bears, and allow seasonal restrictions to protect important moose and caribou calving and wintering areas and important waterfowl habitat.

Comment Summary: Ms. Westphal stated that the lake is appreciated as a recreational resource in the community and local and tourist use of the lake has greatly increased in recent years. The lake and its potential for commercial, tourism-related development will be damaged by industrial drilling and development in this area.

ADNR Response: See response to Common Issues 2, 3, and 9.

Comment Summary: Ms. Westphal stated that the area has a cold climate where bio-composting of industrial wastes are slowed by the cold temperatures, and that tundra and taiga forest disturbed by exploration, mining, and other activities do not regenerate and can be seen in high altitude photography many decades after the land has been disturbed.

ADNR Response: Industrial waste will not be composted. Waste from operations must be reduced, reused, or recycled to the maximum extent practicable. Garbage and domestic combustibles remaining after reuse or recycling must be incinerated whenever possible or disposed at an approved site in accordance with ADEC regulations. Mitigation Measures A(5)(a)-(d) address waste disposal.

Comment Summary: Ms. Westphal stated that the residential 500 foot setback for drilling pads is inadequate to protect land values and water quality, that the 1,500 foot setback for compressor stations does not provide an adequate buffer, as highway noises can be heard a mile away and train noises three miles away, that ground water aquifers will be impacted by the volumes required for industrial use, and that problems with residential wells can be expected.

ADNR Response: See response to Common Issues 3 and 6.

Comment Summary: Ms. Westphal stated that the potential to provide cost-effective local energy sources for commercial or residential uses was cited in the preliminary finding, but this is unlikely because of the cost to install infrastructure to distribute energy to the widely dispersed population in the area, and therefore the benefit to the community is not feasible.

ADNR Response: See response to Common Issue 5.

Comment Summary: Ms. Westphal stated that local residents will be harmed if industrial sites surround their acreage, that water quality will be compromised, the scenic beauty will be diminished, the peace of the area will disappear, and land values will be lowered. She stated that the best interest finding lists negative impacts that are far more serious and far outweigh any benefits identified for the state or local community.

ADNR Response: See responses to Common Issues 1, 2, 3, 4, and 6. Mitigation Measures, listed in Chapter Nine and discussed in Chapter Eight, as well as other regulatory protections, are expected to avoid, minimize, or mitigate potential negative effects.

Comment Summary: Ms. Westphal stated that she agrees with the suggestion to confine exploration and development to the east side of the Nenana River, with the exception of the Ferry residences and residences and businesses north of the Coghill Bridge, locally known as the Rex Bridge. She stated that this compromise has the benefit of preserving the economic development along the Parks Highway corridor, protects the environment around the national park, and preserves the traditional quality of life.

ADNR Response: See response to Common Issues 7 and 8.

15. Westphal, Lyle

Healy, AK. Letter of October 20, 2005

Comment Summary: Mr. Westphal stated that he agrees with confining exploration and development to the east side of the Nenana River, with the exception of the Ferry residences and residences and businesses north of the Coghill Bridge, locally known as the Rex Bridge.

ADNR Response: See response to Common Issue 7.

Comment Summary: Mr. Westphal stated that the preliminary finding listed more negative impacts on the area than positive.

ADNR Response: In making a finding of whether an exploration license is in the state's best interest, the director weighs the facts, issues, comments received during the public comment period, and applicable laws and regulations, and balances the potential positive and negative effects given the mitigation measures and other regulatory protections.

Comment Summary: Mr. Westphal stated that the 500 foot setback for drilling pads is inadequate to protect water quality and property values, and that the 1,500 foot setback for compressor stations does not provide an adequate buffer because highway noises can be heard from a mile away and train noises from three miles away.

ADNR Response: Mitigation Measure A(1)(b)(iii) addresses noise impacts. The 500 and 1,500 foot setbacks are minimums. Specific setbacks will be established at the plan of operations phase when a specific project at a specific location is proposed. See response to Common Issue 6.

Comment Summary: Mr. Westphal stated that the area has a cold climate where bio-composting of industrial wastes are slowed by the cold temperatures, and that tundra and taiga forest disturbed by exploration, mining, and other activities do not regenerate and can be seen in high altitude photography many decades after the land has been disturbed. He stated that ground water aquifers will be impacted by the volumes required for industrial use, and that problems with residential wells can be expected.

ADNR Response: Industrial waste will not be composted. Waste from operations must be reduced, reused, or recycled to the maximum extent practicable. Garbage and domestic combustibles remaining after reuse or recycling must be incinerated whenever possible or disposed at an approved site in accordance with ADEC regulations. Mitigation Measures A(5)(a)-(d) address waste disposal. See response to Common Issue 3.

16. Wilson, Grady

Healy Meeting. October 10, 2005

Comment Summary: Mr. Grady stated that the revenue stream of this project is not expected to significantly impact the overall oil and gas revenue of the State of Alaska.

ADNR Response: Given the estimated high potential for shallow coal bed gas in the Healy area, it is possible that this project will be able to contribute to state revenues. The level of that contribution is unknown and depends on the outcome of each project phase, and ultimately on levels of gas production. In comparison to the state's total revenue from oil and gas activities, the anticipated revenue from the Healy exploration license is unlikely to cause a significant percentage increase. However, the potential availability of natural gas on the road system close to the communities of central and Southcentral Alaska could have a positive impact beyond the value of royalty income to the state. Although production of natural gas resources from coal has yet to be fully developed, the potential of coal as a significant source of clean-burning natural gas in Alaska is promising.

Comment Summary: Mr. Grady stated that although the preliminary finding states that residents of some communities will gain access to natural gas and the potential to reduce local energy costs, there is no evidence to presented to support this claim. He stated that there is no cost-benefit analysis of what would be required to create such an infrastructure, who would build it, or how it would be financed.

ADNR Response: The finding says that some communities *may* gain access to natural gas, a lower cost alternative to fuel oil and electricity for heating. Local utilities may be able to generate electricity from natural gas, which is more efficient, less expensive, and less polluting than diesel. The cost of building infrastructure will depend on where gas is discovered.

Comment Summary: Mr. Grady stated that there are no definite requirements to hire and train local residents.

ADNR Response: Mitigation Measure A(8) encourages the licensee to employ local and Alaska residents and contractors for work performed in the license area, to the extent they are available and qualified. Before beginning work, the licensee submits, as part of the plan of operations, a proposal detailing the means by which the licensee will comply with the measure. The proposal must include a description of the operator's plans for partnering with local communities to recruit, train, and hire local and Alaska residents and contractors. In formulating this proposal, the licensee is encouraged to coordinate with employment services offered by the State of Alaska and local communities and to recruit employees from local communities.

Comment Summary: Mr. Grady stated that the community could experience job losses if tourists are not inclined to spend money and time to recreate and sightsee in the middle of an industrial gas operation.

ADNR Response: See response to Common Issue 2. All mitigation measures contribute to ensuring that local fish and wildlife populations and habitats and their uses are protected, and thus the area's tourism values and economy are protected.

17. Wribel, Richard

Healy, AK. Letter of October 31, 2005

Comment Summary: Mr. Wribel stated that the exploration license should be denied, at a minimum on the west side of the Nenana River.

ADNR Response: See response to Common Issue 7.

Comment Summary: Mr. Wribel stated that the applicant has stated that it is unlikely that gas will be available for home use or by anyone in the local area, except the applicant, and that the preliminary finding noted that the potential revenue stream from the activity would be insignificant, and therefore the applicant will receive all the benefits and the community will bear all the costs.

ADNR Response: See response to Common Issue 5. Given the estimated high potential for shallow coal bed gas in the Healy area, it is possible that this project will contribute to state revenues. The level of that contribution is unknown and depends on the outcome of each project phase, and ultimately on levels of gas production. In comparison to the state's total revenue from oil and gas activities, the anticipated revenue from the Healy exploration license is unlikely to cause a significant percentage increase. However, the potential availability of natural gas on the road system close to the communities of central and Southcentral Alaska could have a positive impact beyond the value of royalty income to the state. Although production of natural gas resources from coal has yet to be fully developed, the potential of coal as a significant source of clean-burning natural gas in Alaska is promising.

Comment Summary: Mr. Wribel stated that the applicant's proposed activity is incompatible with the local major industry, the tourist industry, that pays most of the local taxes collected by the Denali Borough, and that if the state wants to develop gas resources, there are better places to do it than in the Healy area, and therefore the permit should be denied.

ADNR Response: See response to Common Issue 2.

Comment Summary: Mr. Wribel stated that the setbacks proposed in Chapter Nine are inadequate and should be changed to "no specific activities within one mile of any residence". He stated that another mitigation measure prohibits use of diesel-based fracturing materials, that this prohibition should be extended to all hydrocarbon-based material, and that the permit (should it be issued) should include a provision to train local emergency service providers and fund them at a specific annual level, for example at $100,000 per year, for the duration of the permitted activities.

ADNR Response: Setbacks combined with the comprehensive mitigation measures addressing sight and sound impacts are expected to avoid, minimize, or mitigate potential impacts to local residences (Mitigation Measures A(1)(b). Mitigation Measure A(1)(a)(iv) address emergency preparedness and response.

D. References

BBC (BBC Research and Consulting)

2001 Measuring the impact of coalbed methane wells on property values. Appendix B *in*: La Plata County impact report: Final oil and gas impact report, La Plata County. Final report published October 2002. http://co.laplata.co.us/publications/og_impactreport.htm

Appendix B: Laws and Regulations Pertaining to Natural Gas Exploration, Development, Production, and Transportation

Table of Contents

Appendix B: Laws and Regulations Pertaining to Natural Gas Exploration, Development, Production, and Transportation

A. Alaska Statutes (AS) and Administrative Code (AAC)

1. Alaska Department of Natural Resources (ADNR)

AS 38.05.027	Management of legislatively designated state game refuges and critical habitat areas is joint responsibility of ADF&G (AS 16.20.050-060) and ADNR. Lessees are required to obtain permits from both ADNR and ADF&G.
AS 38.05.127	Provides for reservation of easements to ensure free access to navigable or public water.
AS 38.35.010 to AS 38.35.260	Right-of-way leasing for pipeline transportation of crude oil and natural gas is under control of commissioner of ADNR. Commissioner shall not delegate authority to execute leases.
11 AAC 51.045	Easements to and along navigable or public water.
11 AAC 83.158(a)	Plan of operations for all or part of leased area or area subject to oil and gas exploration license must be approved by ADNR commissioner before any operations may be undertaken on or in leased or licensed area.
11 AAC 96.010	Operations requiring permits, including use of explosives and explosive devices, except firearms.
11 AAC 96.025	Generally allowed land use activities are subject to general stipulations that will minimize surface damage or disturbance of drainage systems, vegetation, or fish and wildlife resources.

2. ADNR Division of Oil and Gas (DO&G)

AS 38.05.035(a)(8)(C)	Requires geological and geophysical data to be kept confidential upon request of supplier.
AS 38.05.130	Allows DO&G director to approve oil and gas exploration and development activities in cases where surface estate is not held by state or is otherwise subject to third-party interests, provided director determines that adequate compensation has been made to surface estate holder for any damages that may be caused by lease activities.
AS 38.05.180	Establishes an exploration licensing program.
AS 38.05.132	Establishes exploration licensing program.

AS 38.05.180	Establishes oil and gas leasing and gas only leasing programs to provide for orderly exploration for and development of petroleum resources belonging to the State of Alaska.
11 AAC 96.010 to 11 AAC 96.145	Provides controls over activities on state lands in order to minimize adverse activities; applies to geophysical exploration permit.

3. ADNR Division of Forestry

AS 41.17.082	Alaska Forest Resources Practices Act. Requires that all forest clearing operations and silvicultural systems be designed to reduce likelihood of increased insect infestation and disease infections that threaten forest resources.
11 AAC 95.195	Describes approved methods of disposal or treatment of downed spruce trees to minimize spread of bark beetles and reduce risk of wildfire.
11 AAC 95.220	Requires lessee to file detailed plan of operations with state forester.

4. ADNR Division of Mining, Land and Water

AS 38.05.075	Governs public auctions for leasing lands (including tidelands and submerged lands) — procedures, bidding qualifications, and competitive or noncompetitive bidding methods.
AS 38.05.850	Authorizes the director to issue permits, rights-of-way, or easements on state land for recovery of minerals from adjacent land under valid lease.
11 AAC 80.005 to 11 AAC 80.085	Establishes pipeline right-of-way leasing regulations.
11 AAC 93.040 to 11 AAC 93.130	Requires a water rights permit for appropriation of state waters.
11 AAC 93.210 to 11 AAC 93.220	Provides for temporary water use permits and application procedures.
11 AAC 96.010 to 11 AAC 96.110	Land use permit activities not permitted by multiple land use permit or lease operations approval.

5. Alaska Department of Fish and Game (ADF&G)

AS 16.05.841	Requires that an obstruction across a fishbearing stream provide for fish passage.
AS 16.05.871	Provides for protection of anadromous fish and game in connection with construction or work in beds of specified water bodies and calls for approval of plans by ADF&G for construction of hydraulic project or any use, diversion, obstruction, change, or pollution of these water bodies.

AS 16.20	Manages legislatively designated game refuges, sanctuaries, and critical habitat areas.
AS 16.20.060 and AS 16.20.530	Commissioner, ADF&G, may require submission and written approval of plans and specifications for anticipated use and construction work and plans for proper protection of fish and game (including birds) within legislatively designated game refuges, critical habitat areas, and sanctuaries.
AS 16.20.180 to AS 16.20.210	Requires measures for continued conservation, protection, restoration, and propagation of endangered fish and wildlife.
5 AAC 95.010	Atlas and catalog of waters important for spawning, rearing, or migration of anadromous fish. Permit application procedures.

6. Alaska Oil and Gas Conservation Commission (AOGCC)

AS 31.05.005	Establishes and empowers AOGCC.
AS 31.05.030(d)(9)	Requires oil and gas operator to file and obtain approval of plan of development and operation.
AS 46.03.100	Standards and limitations for accumulation, storage, transportation, and disposal of solid or liquid waste or heated process or cooling water.
AS 46.03.900(35)	Defines waste.
20 AAC 25	Requires permit to drill, to help maintain regulatory control over drilling and completion activities in state. Regulates well spacing and underground injection.
20 AAC 25.140	Requires authorization to allow an abandoned oil and gas well to be converted to a freshwater well.

7. Alaska Department of Environmental Conservation (ADEC)

AS 26.23.900(1)	Defines Alaska State Emergency Response Commission.
AS 46.03	Sets state policy; to conserve, improve, and protect the state's natural resources and environment, and control water, land, and air pollution.
AS 46.03.100	Requires solid waste disposal permits.
AS 46.03.759	Establishes maximum liability for discharge of crude oil at $500 million.
AS 46.03.900(35)	Defines waste.

AS 46.04	Oil and Hazardous Substance Pollution Control Act. Prohibits discharge of oil or any other hazardous substances unless specifically authorized by permit; requires those responsible for spills to undertake cleanup operations; and holds violators liable for unlimited cleanup costs and damages as well as civil and criminal penalties.
AS 46.04.030	Requires lessees to provide oil discharge prevention and contingency plans (C-plans). Also provides regulation of aboveground storage facilities that have capacities of greater than 5,000 bbl of crude oil or greater than 10,000 bbl of noncrude oil.
AS 46.04.050	Exemptions for oil terminal facilities that have capacities of less than 5,000 bbl of crude oil or less than 10,000 bbl of noncrude oil. Exemption for natural gas exploration facilities if AOGCC determines that all wells at the facility will not penetrate a formation capable of flowing oil to the surface.
18 AAC 50	Provides for air quality control, including permit requirements, permit review criteria, and regulation compliance criteria.
18 AAC 50.316	Preconstruction review for construction or reconstruction of major source of hazardous air pollutants.
18 AAC 60.200	Requires a solid waste disposal permit.
18 AAC 60.265	Requires proof of financial responsibility before a permit for operation of hazardous waste disposal facility may be issued.
18 AAC 60.430(a)(2)	General requirement for containment structures used for disposal of drilling wastes.
18 AAC 70	Sets water quality standards.
18 AAC 72	Protects public health, public and private water systems, and the environment from diseases transmitted by domestic wastewater by establishing minimum treatment, construction, operation, and maintenance standards for domestic wastewater treatment works and disposal systems.
18 AAC 75.005 to 18 AAC 75.025	Requirements for oil storage facilities for oil pollution prevention.
18 AAC 75.065 to 18 AAC 75.075	Requirements for oil storage tanks.
18 AAC 75.080	Facility piping requirements for oil terminal, crude oil transmission pipeline, and exploration and production facilities. Requires a corrosion control program.
18 AAC 75.235	Sets financial responsibility levels for oil discharges

18 AAC 75.300	Requires ADEC be notified of spill of oil and other hazardous substances.
18 AAC 75.400 to 18 AAC 75.496	Requires oil discharge contingency plans and specifies their contents.

B. Federal Laws and Regulations

CFR is the Code of Federal Regulations; USC is the United States Code.

1. Clean Water Act

33 USC §§ 1251 to 1387	Establishes water pollution controls to restore and maintain the integrity of U.S. waters
33 USC § 1344	Requires a COE Section 404 permit to excavate, fill, alter, or otherwise modify course or condition of navigable or U.S. coastal waters and to discharge dredge-and-fill material

2. Environmental Protection Agency (EPA)

Oil and other hazardous substance regulations.

40 CFR § 109	Establishes criteria for oil removal (spill) contingency plans
40 CFR § 110	Requires reporting of spills
40 CFR § 112	Oil pollution prevention, designed to form a comprehensive federal/state spill prevention program that minimizes the potential for discharges
40 CFR § 112.7	General requirements for spill prevention, control, and countermeasures plan
40 CFR § 113	Sets liability limits for small onshore storage facilities (oil)
40 CFR § 116	Designates hazardous substances
40 CFR § 117	Determination of reportable quantities for hazardous substances

Water quality regulations.

40 CFR § 121	State certification of activities requiring federal license or permit which may result in any discharge into navigable waters
40 CFR § 122	NPDES permit regulations
40 CFR § 125	Sets criteria and standards for NPDES permits

40 CFR § 129	Sets toxic pollutant effluent standards and lists toxic pollutants
40 CFR § 136	Establishes test procedures for the analysis of pollutants
40 CFR § 401	Prescribes effluent limitations guidelines and standards
40 CFR § 435	Sets discharge criteria for onshore and offshore facilities

Underground injection regulations.

40 CFR § 144	Requirements for underground injection control program
40 CFR § 146	Sets technical criteria and standards for the underground injection control program
40 CFR § 147	Sets forth state-administered underground injection control program

Materials discharge and disposal regulations.

40 CFR § 230	Regulates the discharge of dredged or fill material into navigable waters
40 CFR § 231	Sets the procedures for approving or prohibiting disposal of dredged or fill material at a site

Oil and other hazardous substance pollution regulations.

40 CFR § 300	National Oil and Hazardous Substances Pollution Contingency Plan, to provide for efficient, coordinated, and effective response to discharges of oil and hazardous substances

3. Army Corps of Engineers

Navigable waters regulations.

33 CFR § 209.200	Regulations governing navigable waters
33 CFR §§ 320 to 327 and 330	Prescribes policies and procedures applicable to review of applications for certain activities in U.S. waters, including discharge of dredged or fill material, including nationwide permits
33 CFR §§ 328 and 329	Defines waters and navigable waters of the U.S.

4. Fish and Wildlife Coordination Act

16 USC § 662(a)	Requires consultation between agencies on activities conducted in waters.

5. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

42 USC §§ 9601 to 9675	Defines and designates hazardous substances, sets quantities for reportable releases, and sets cleanup standards

6. Safe Drinking Water Act

42 USC § 300 (f) to (h)	Regulates public water systems to ensure their safety

7. Solid Waste Disposal Act, as amended by Resource Conservation and Recovery Act

42 USC §§ 6901 to 6991	Regulates solid waste disposal planning and management and sets reduction or elimination of hazardous waste as national policy

8. Clean Air Act

42 USC §§ 740l to 7671	Encourages and promotes reasonable governmental actions for air pollution prevention; sets standards, and permit requirements

9. Toxic Substances Control Act

15 USC §§ 2601 to 2655	Controls toxic substances, including asbestos

10. National Environmental Policy Act (NEPA)

42 USC §§ 4321 to 4347	Sets environmental policy; requires a detailed statement of environmental impacts in reports on proposed federal actions significantly affecting the quality of the environment.

Council on Environmental Quality-administers NEPA-related regulations

40 CFR §§ 1500 to 1508	Provides regulations applicable to and binding on federal agencies for implementing NEPA, including when and whether to prepare and environmental impact statement

11. Endangered Species Act

16 USC §§ 1531 to 1543	Interagency cooperation, prohibited acts, penalties, and enforcement

12. USF&WS

Threatened and endangered species regulations

50 CFR § 17	Threatened and endangered wildlife and plant species
50 CFR § 402	Directs federal agencies to further the purposes of the Endangered Species Act

13. Pipeline Inspection, Protection, Enforcement, and Safety Act (PIPES Act) of 2006

49 CFR § 192	Prescribes minimum safety requirements for pipeline facilities and the transportation of gas
49 CFR § 195	Prescribes safety standards and reporting requirements for pipeline facilities used in the transportation of hazardous liquids or carbon dioxide

14. Migratory Bird Treaty Act

16 USC §§ 703 to 712 and 715	Protects migratory birds, per the act and international treaties

15. Archaeological and Historic Preservation Act

16 USC § 469	Preserves historical and archaeological data that might be lost or destroyed due to a federally licensed activity

16. National Historic Preservation Act

16 USC § 470	Protects prehistoric and historic resources

17. Leases and Permits on Restricted Properties

25 CFR § 162	Leasing and permitting on Native and restricted lands

C. Local Laws and Regulations

1. Denali Borough

9 DBC 25.010	Denali Borough land management regulations (Denali Borough Code (DBC)), planning, and permitting powers. Requires facility setbacks from adjoining property and allows for variances.

Appendix C: Exploration License

Gas Only Exploration License
Form #DOG 2005-07

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES

Exploration License
ADL 390606

THIS GAS ONLY EXPLORATION LICENSE is issued by the State of Alaska, Department of Natural Resources ("the state" or "the department") to

USIBELLI COAL MINE, INC.

("the licensee") whether one or more, whose address for purposes of notification is set out in Paragraph 17.

In consideration of the nonrefundable Gas only exploration license fee, work commitment, and performance bond, and subject to the provisions of this exploration license ("license"), including the attached schedules, and by reference, incorporated into this license, the state and the licensee agree as follows.

1. GRANT. (a) Subject to the provisions contained in this license, the state grants to the licensee the exclusive right to explore for Gas on the state lands described in Schedule 1 ("licensed land"), unless this license is terminated in whole or part under the provisions of this license or applicable statutes and regulations.

(b) This license may be converted to one or more Gas only Leases under the provisions of AS 38.05.134 and 11 AAC 82.978.

(c) If the state's ownership interest in the Gas in the licensed land is less than an entire and undivided interest, the grant under this license is effective only as to the state's interest in that Gas.

(d) The state makes no representations or warranties, express or implied, as to title, or access to, or quiet enjoyment of, the licensed land. The state is not liable to the licensee for any deficiency in title to the licensed land, nor is the licensee or any successor in interest to the licensee entitled to any refund due to deficiency in title for work commitments or other expenditures made under this license.

2. RESERVED RIGHTS. (a) The state, for itself and others, reserves all rights not expressly granted to the licensee. These reserved rights include, but are not limited to:

(1) the right to dispose of to others the surface of the licensed land subject to the license, and the right to authorize others by grant, lease, or permit, subject to the license;

(2) the right to explore for Oil or Gas by geological or geophysical means including the drilling of shallow core holes or stratigraphic tests to a depth of not more than 1,000 feet;

(3) the right to explore for, develop, and remove natural resources other than Gas on or from the licensed land;

(4) the right to non-exclusive easements and rights-of-way for any lawful purpose, including shafts and tunnels necessary or appropriate for working of the licensed land or other land for natural resources other than Gas;

(5) the right to well sites and well bores of wells drilled from or through the licensed land to explore for or produce Oil, Gas, and Associated Substances in and from other land; and

(6) the right to undertake any other purpose authorized by law and not inconsistent with the rights under the license.

(b) Reserved rights may be exercised by the state, or by any person or entity acting under authority of the state, in any manner that does not unreasonably interfere with or endanger the licensee's operations under this license.

3. TERM. This license is issued for a term of **10** years from the Effective Date.

4. WORK COMMITMENT. This license is conditioned upon the performance of a work commitment, as required under AS 38.05.132, of **$500,000.00**. Failure of the licensee to timely meet this work commitment will result in the relinquishment, removal, or deletion of the licensed land, termination of this license, and forfeiture of the bond under the provisions of AS 38.05.132 and 11 AAC 82903—11AAC82.990.

5. GEOLOGIC AND GEOPHYSICAL DATA. (a) On or before each Anniversary Date of the Effective Date of this license, the licensee shall submit to the department all geologic and geophysical data, as defined in 11 AAC 82.990, in accordance with 11 AAC 82.981 and 11 AAC 82.984.

6. BONDING. (a) On or before the Effective Date of this license the licensee shall post, and during the term of this license the licensee shall maintain, a performance bond or other security in accordance with AS 38.05.132 and 11 AAC 82.945. The form to be used for bond calculations is incorporated as Schedule 2 to this license.

7. FORCE MAJEURE. (a) If by the fourth anniversary of this license the state determines that the licensee has been prevented by Force Majeure from performing an act that would maintain this license, the Effective Date of this license will be extended by adding the time lost as result of the Force Majeure.

(b) If Force Majeure occurs after the fourth anniversary and before the expiration of the term of this license, the term of this license will be extended by adding the period of time lost as a result of the Force Majeure.

8. AUDIT. The commissioner will, in the commissioner's discretion, audit expenditures as set out in 11 AAC 82.960. The licensee shall keep and have in its possession books and records showing all expenditures regarding the licensee's direct exploration expenditures, reports, data, or other information relevant to the drilling of a Gas exploration well or the gathering of geologic or geophysical data, whether or not that information is confidential. The licensee shall permit the state or its agents to examine these books and records at all reasonable times. Upon request by the state, the licensee's books and records must be made available to the state at the state office designated by the state. These books and records must employ methods and techniques that will ensure the most accurate figures reasonably available. The licensee shall use generally accepted accounting procedures consistently applied.

9. PLAN OF OPERATIONS. Before operations may be undertaken on the licensed land, the licensee shall comply with the applicable statutes and regulations in effect on the date the proposed activity is scheduled to commence, including the provisions of AS 38.05.130 and 11 AAC 82.951.

10. INSPECTION. The licensee shall keep open at all reasonable times, for inspection by any duly authorized representative of the State of Alaska, the licensed land, all wells, improvements, machinery, and fixtures on the licensed land, and all reports and records relative to operations and surveys or investigations on or with regard to the licensed land or under this license. Upon request, the licensee shall furnish the State of Alaska with copies of and extracts from any such reports and records.

11. ASSIGNMENT. This license, or an interest in this license, may be assigned or otherwise transferred in accordance with 11 AAC 82.966, 11 AAC 82.969, and 11 AAC 82.972.

12. SURRENDER. The licensee may, at any time, file with the state a written surrender of rights under the provisions of 11 AAC 82.957.

13. TERMINATION. The commissioner will, in the commissioner's discretion, terminate this license under the provisions of 11 AAC 82.975 for the licensee's failure to comply with any of its provisions, applicable statutes, regulations, or stipulations.

14. RIGHTS UPON SURRENDER OR TERMINATION. Upon the surrender or termination as to all or any portion of the licensed land, the state will direct the licensee in writing and the licensee will have the right at any time within a period of one year after the surrender or termination, or any extension of that period as the state may grant, to remove from the licensed land or portion of the licensed land all machinery, equipment, tools, and materials. Upon the expiration of that period or extension of that period and at the option of the state, any machinery, equipment, tools, and materials that the licensee has not removed from the licensed land or portion of the licensed land become the property of the state or may be removed by the state at the licensee's expense. At the option of the state, all improvements such as roads, pads, and wells must either be abandoned and the sites rehabilitated by the licensee to the satisfaction of the state, or be left intact and the licensee absolved of all further responsibility as to their maintenance, repair, and eventual abandonment and rehabilitation. Subject to the above conditions, the licensee shall deliver the licensed land or those portions of the licensed land in good condition.

15. DAMAGES AND INDEMNIFICATION. (a) The licensee shall indemnify the state for, and hold it harmless from, any claim, including claims for loss or damage to property or injury to any person caused by or resulting from any act or omission committed under this license by or on behalf of the licensee. The licensee is not responsible to the state under this subparagraph for any loss, damage, or injury caused by or resulting from the sole negligence of the state.

(b) The licensee expressly waives any defense to an action for breach of a provision of this license or for damages resulting from an oil spill, well blow-out, or other harm to the environment that is based on an act or omission committed by an independent contractor in the licensee's employ. The licensee expressly agrees to assume responsibility for all actions of its independent contractors.

16. AUTHORIZED REPRESENTATIVES. The Director of the Division of Oil and Gas, Department of Natural Resources, State of Alaska, and the person executing this license on behalf of the licensee will be authorized representatives for their respective principals for the purposes of administering this license. The state or the licensee may change the designation of its authorized representative or the address to which notices to that representative are to be sent by a notice given in accordance with Paragraph 17 below. When activities under a plan of operations are underway, the licensee shall also designate, by notice under Paragraph 17 below, by name, job title, and address, an agent who will be present in the state during all license activities.

17. NOTICES; PROTEST. (a) Any notices required or permitted under this license must be by electronic media producing a permanent record or in writing and must be given personally or by registered or certified mail, return receipt requested, addressed as follows:

TO THE STATE:

DIRECTOR, DIVISION OF OIL AND GAS
DEPARTMENT OF NATURAL RESOURCES
550 WEST 7TH AVENUE, SUITE 800
ANCHORAGE, ALASKA 99501-3560

TO THE LICENSEE:

PRESIDENT
USIBELLI COAL MINE, INC.

(b) Any notice given under this paragraph will be effective when delivered to the above authorized representative.

18. APPEALS. The licensee shall appeal decisions of the commissioner related to this license in accordance with 11 AAC 82.963.

19. STATUTES AND REGULATIONS. This license is subject to all applicable state and federal statutes and regulations in effect on the Effective Date of this license, and to all statutes and regulations placed in effect after the Effective Date of this license. A reference to a statute or regulation in this license includes any future change in that statute or regulation whether by amendment, repeal and replacement, or other means. This license does not limit the power of the State of Alaska or the United States of America to enact and enforce legislation or to promulgate and enforce regulations affecting, directly or indirectly, the activities of the licensee or its agents in connection with this license or the value of the interest held under this license. In case of conflicting provisions, statutes and regulations take precedence over this license.

20. INTERPRETATION. This license is to be interpreted in accordance with the rules applicable to the interpretation of contracts made in the State of Alaska. The paragraph headings are not part of this license and are inserted only for convenience. The state and the licensee expressly agree that the law of the State of Alaska will apply in any judicial proceeding affecting this license.

21. WAIVER OF CONDITIONS. The state reserves the right to waive any breach of a provision of this license, but any waiver extends only to the particular breach waived and does not limit the rights of the state with respect to any future breach; nor will the waiver of a particular breach prevent cancellation of this license for any other cause or for the

same cause occurring at another time. Notwithstanding the foregoing, the state will not be deemed to have waived a provision of this license unless it does so in writing.

22. SEVERABILITY. If it is finally determined in any judicial proceeding that any provision of this license is invalid, the state and the licensee may jointly agree by a written amendment to this license that, in consideration of the provisions in that written amendment, the invalid portion will be treated as severed from this license and that the remainder of this license, as amended, will remain in effect.

23. NONDISCRIMINATION. The licensee and the licensee's contractors and subcontractors may not discriminate against any employee or applicant because of race, religion, marital status, change in marital status, pregnancy, parenthood, physical handicap, color, sex, age, or national origin as set out in AS 18.80.220. The licensee and its contractors and subcontractors shall, on beginning any operations under this license, post in a conspicuous place notices setting out this nondiscrimination provision.

24. DEFINITIONS. To the extent that the words and phrases used in this license are defined in 11 AAC 82.990, those definitions will apply to this license. With respect to all other words and phrases used in this license, they will be interpreted in accordance with AS. 01.10.040. However, the following words have the following meanings unless the context unavoidably requires otherwise.

(1) "Anniversary Date" means the date in each successive calendar year following the Effective Date that is the same as the Effective Date.

(2) "Associated Substances" means all substances except helium produced as an incident of production of Oil or Gas by ordinary production methods and not defined in this license as Oil or Gas;

(3) "Effective Date" means the first day of the month following the date on which the exploration license or, if an extension is granted, the extension was signed on behalf of the state or, upon written request, on the first day of the month in which it was signed on behalf of the state.

(4) "Force Majeure" means war, riots, acts of God, unusually severe weather, or any other cause beyond the licensee's reasonable ability to foresee or control and includes operational failure of existing transportation facilities and delays caused by judicial decisions or lack of them.

(5) "Gas" means all natural gas (except helium gas) and all other hydrocarbons produced that are not defined in this license as Oil;

(6) "Oil" means crude petroleum oil and other hydrocarbons, regardless of gravity, that are produced in liquid form by ordinary production methods, including liquid hydrocarbons known as distillate or condensate recovered by separation from Gas other than at a Gas processing plant.

BY SIGNING THIS LICENSE, the state and the licensee agree to be bound by its provisions.

STATE OF ALASKA

By: _____ Date: _____
Kevin R. Banks
Director, Division of Oil and Gas

STATE OF ALASKA)
) ss.
Third Judicial District)

On , before me appeared Kevin R. Banks of the Division of Oil and Gas of the State of Alaska, Department of Natural Resources, and who executed this license and acknowledged voluntarily signing it on behalf of the State of Alaska as lessor.

_____
Notary public in and for the State of Alaska
My commission expires _____

LICENSEE: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LICENSEE'S SIGNATURE HERE

SCHEDULE 2

Annual Bonding Calculation

(This schedule must be updated and submitted annually to the Division of Oil & Gas)

1.	Enter	Beginning Work Commitment	$ _____
2.	Enter	Cumulative Direct Exploration Expenditures	$ _____
3.	Line 1 Minus Line 2	Balance of Remaining Work Commitment	$ _____
4	Enter	# of Years Remaining in Term of License	_____
5	Line 3 Divided by Line 4	Annual Bond Due	$ _____

Appendix D: Conversion Lease

Gas Only Conversion Lease
Form #DOG 2005-07A

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES

Gas Only Exploration License
Conversion Lease

ADL No. _____

THIS LEASE is entered into on , between the State of Alaska, "the state," and

"the lessee," whether one or more, whose sole address for purposes of notification is under Paragraph 26.

In consideration of the cash payment made by the lessee to the state, which payment includes the first year's rental and subject to the provisions of this lease, including all attached stipulation(s) and mitigating measures incorporated herein by reference, the state and the lessee agree as follows:

1. GRANT. (a) Subject to the provisions in this lease, the state grants and leases to the lessee, without warranty, the exclusive right to drill for, extract, remove, clean, process, and dispose of Gas in or under the following described tract of land:

containing approximately acres, more or less (referred to in this lease as the "leased area"); the nonexclusive right to conduct within the leased area geological and geophysical exploration for Gas; and the nonexclusive right to install pipelines and build structures on the leased area to find, produce, save, store, treat, process, transport, take care of, and market all Gas and to house and board employees in its operations on the leased area. The rights granted by this lease are to be exercised in a manner which will not unreasonably interfere with the rights of any permittee, lessee or grantee of the state consistent with the principle of reasonable concurrent uses as set out in Article VIII, Section 8 of the Alaska Constitution.

(b) For the purposes of this lease, the leased area contains the legal subdivisions as shown on the attached Exhibit A.

(c) If the leased area is described by protracted legal subdivisions, the provisions of 11 AAC 82.645 -.660 apply.

(d) If the state's ownership interest in the Gas in the leased area is less than an entire and undivided interest, the grant under this lease is effective only as to the state's interest in that Gas, and the royalties and rentals provided in this lease must be paid to the state in the proportion that the state's interest bears to the entire undivided fee.

(e) The state makes no representations or warranties, express or implied, as to title, or access to, or quiet enjoyment of, the leased area. The state is not liable to the lessee for any deficiency in title to the leased area, nor is the lessee or any successor in interest to the lessee entitled to any refund due to deficiency in title for any rentals, bonuses, or royalties paid under this lease.

2. RESERVED RIGHTS. (a) The state, for itself and others, reserves all rights not expressly granted to the licensee. These reserved rights include, but are not limited to:

(1) the right to dispose of to others the surface of the licensed land subject to the license, and the right to authorize others by grant, lease, or permit, subject to the license;

(2) the right to explore for Oil or Gas by geological or geophysical means including the drilling of shallow core holes or stratigraphic tests to a depth of not more than 1,000 feet;

(3) the right to explore for, develop, and remove natural resources other than Gas on or from the licensed land;

(4) the right to non-exclusive easements and rights-of-way for any lawful purpose, including shafts and tunnels necessary or appropriate for working of the licensed land or other land for natural resources other than Gas;

(5) the right to well sites and well bores of wells drilled from or through the licensed land to explore for or produce Oil, Gas, and Associated Substances in and from other land; and

(6) the right to undertake any other purpose authorized by law and not inconsistent with the rights under the license.

(b) Reserved rights may be exercised by the state, or by any person or entity acting under authority of the state, in any manner that does not unreasonably interfere with or endanger the licensee's operations under this license.

3. TERM. This lease is issued for an initial primary term of ___ years from the Effective Date of this lease. The term may be extended as provided in Paragraph 4 below.

4. EXTENSION. (a) This lease will be extended automatically if and for so long as Gas is produced from the leased area in Paying Quantities.

(b) This lease will be extended under the provisions of 11 AAC 83.190 if it is committed to a unit agreement approved or prescribed by the state.

(c) (1) This lease will be extended under the terms of 11 AAC 83.125 If the drilling of a well whose bottom hole location is in the leased area has commenced as of the date on which the lease otherwise would expire.

(2) If Gas in Paying Quantities is produced from the leased area, and that production ceases at any time, this lease will continue under the provisions of 11 AAC 83.130.

(d) If there is a well capable of producing Gas in Paying Quantities on the leased area, this lease will be extended under the provisions of 11 AAC 83.135.

(e) If the state directs or approves in writing a suspension of all operations on or production from the leased area (except for a suspension necessitated by the lessee's negligence), or if a suspension of all operations on or production from the leased area has been ordered under federal, state, or local law, the lessee's obligation to comply with any express or implied provision of this lease requiring operations or production will be suspended, but not voided, and the lessee shall not be liable for damages for failure to comply with that provision. If the suspension occurs before the expiration of the primary term, the primary term will be extended at the end of the period of the suspension by adding the period of time lost under the primary term because of the suspension. If the suspension occurs during an extension of the primary term under this paragraph, upon removal of that suspension, the lessee will have a reasonable time, which will not be less than six months after Notice that the suspension has been removed, to resume operations or production. For the purposes of this subparagraph, any suspension of operations or production specifically required or imposed as a term of sale or by any stipulation made a part of this lease will not be considered a suspension ordered by law.

5. FORCE MAJEURE. (a) If the state determines that the lessee has been prevented by Force Majeure from performing an act necessary to maintain this lease, this lease will not expire during the period of Force Majeure.

(b) If Force Majeure occurs before the expiration of the primary term of this lease, the primary term will be extended by adding the period of time lost as a result of the Force Majeure.

(c) Nothing in this section suspends the obligation of the lessee to pay rentals and royalties when due.

6. RENTALS. (a) The lessee shall pay an annual rental to the state of $3.00 per acre or fraction of an acre, provided that the state may increase the annual rental rate as provided by law upon extension of this lease beyond the primary term.

(b) Annual rental paid in advance is a credit on the royalty due under this lease for that year.

(c) The lessee shall pay the annual rental to the State of Alaska (or any depository designated by the state with at least 60 days Notice to the lessee) in advance, on or before the annual anniversary date of this lease. The state is not required to give Notice that rentals are due by billing the lessee. If the state's (or depository's) office is not open for business on the annual anniversary date of this lease, the time for payment is extended to include the next day on which that office is open for business. If the annual rental is not paid timely, this lease automatically terminates as to both parties at 11:59 p.m., Alaska Standard Time, on the date by which the rental payment was to have been made.

7. RECORDS. The lessee shall keep and have in its possession books and records showing the development and production (including records of development and production expenses) and disposition (including records of sale prices, volumes, and purchasers) of all Gas produced from the leased area. The lessee shall permit the State of Alaska or its agents to examine these books and records at all reasonable times. Upon request by the state, the lessee's books and records shall be made available to the state at the state office designated by the state. These books and records of development, production, and disposition must employ methods and techniques that will ensure the most accurate figures reasonably available without requiring the lessee to provide separate tankage or meters for each well. The lessee shall use generally accepted accounting procedures consistently applied.

8. APPORTIONMENT OF ROYALTY FROM APPROVED UNIT. The landowners' royalty share of the unit production allocated to each separately-owned tract shall be regarded as royalty to be distributed to and among, or the proceeds of it paid to, the landowners, free and clear of all unit expense and free of any lien for it. Under this provision, the state's royalty share of any unit production allocated to the leased area will be regarded as royalty to be distributed to, or the proceeds of it paid to, the state, free and clear of all unit expenses (and any portion of those expenses incurred away from the unit area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing Gas for transportation off the unit area, and free of any lien for them.

9. PAYMENTS. All payments to the State of Alaska under this lease must be made payable to the state in the manner directed by the state, and unless otherwise specified, must be tendered to the state at:

DEPARTMENT OF NATURAL RESOURCES
550 WEST 7TH AVENUE, SUITE 1410
ANCHORAGE, ALASKA 99501-3561
ATTENTION: FINANICAL SERVICES SECTION

or to any depository designated by the state with at least 60 days Notice to the lessee.

10. PLAN OF OPERATIONS. (a) Before operations may be undertaken on the leased area, the lessee shall comply with the applicable statutes and regulations in effect on the date the proposed activity is scheduled to commence, including the provisions of AS 38.05.130 and 11 AAC 83.155 - .160.

(b) Upon completion of operations, the lessee shall inspect the area of operations and submit a report indicating the completion date of operations and stating any noncompliance with requirements imposed as a condition of approval of the plan of which the lessee is aware, or should reasonably be aware.

11. PLAN OF DEVELOPMENT. (a) Except as provided in subparagraph (d) below, within 12 months after determination that a well capable of producing Gas in Paying Quantities exists in the leased area, the lessee shall file two copies of an application for approval by the state of an initial plan of development that must describe the lessee's plans for developing the leased area. No development of the leased area may occur until a plan of development has been approved by the state.

(b) The plan of development must be revised, updated, and submitted to the state for approval annually before or on the anniversary date of the previously approved plan. If no changes from an approved plan are contemplated for the following year, a statement to that effect must be filed for approval in lieu of the required revision and update.

(c) The lessee may, with the approval of the state, subsequently modify an approved plan of development.

(d) If the leased area is included in an approved unit, the lessee will not be required to submit a separate lease plan of development for unit activities.

12. INFORMATION ACQUIRED FROM OPERATIONS. (a) The lessee shall submit to the state all geological, geophysical and engineering data and analyses obtained from the lease within 30 days following the completion of a well. The lessee shall submit to the state data and analyses acquired subsequent to well completion within 30 days following acquisition of that data. The state may waive receipt of operational data from some development, service or injection wells. The state will inform the operator of the waiver prior to well completion. The lessee shall submit the data and analyses to the Division of Oil and Gas, Department of Natural Resources, at the location specified in paragraph 25 of this lease. The data and analyses shall include the following:

(1) a copy of the completion report (AOGCC form 10-407) with an attached well summary, including daily drilling reports, formation tops encountered, a full synopsis of drillstem and formation testing data, an identification of zones of abnormal pressure, oil and gas shows and cored intervals;

(2) latitudinal and longitudinal coordinates for the completed surface and bottom hole locations;

(3) a copy of the permit to drill (AOGCC form 10-401 only, additional documentation not required) and the survey plat of the well location;

(4) a paper copy (no sepia copies) of all final 2-inch open hole and cased hole logs, including measured depth and true-vertical depth versions, specialty logs (such as Schlumberger's cyberlook, formation microscanners and dipmeter logs), composite mud or lithology log and report, measured-while-drilling (MWD) and logged-while-drilling (LWD) logs, velocity and directional surveys;

(5) a digital version of well logs in LAS, LIS or ASCII format on IBM format floppy disks, a digital version of velocity surveys in SEG Y format, a digital version of directional surveys in ASCII format (other formats may be acceptable upon agreement with the Division of Oil and Gas); and

(6) a paper copy of all available well analyses, including geochemical analyses, core analyses (porosity, permeability, capillary pressure, photos, and descriptions), paleontologic and palynologic analyses, thermal maturation analyses, pressure build up analyses, and fluid PVT analyses (an ASCII format digital version of the above information shall also be submitted, if available). The state may require the lessee to submit additional information in accordance with the applicable statutes and regulations in effect at the time of the completion date of the well.

(b) Any information submitted to the state by the lessee in connection with this lease will be available at all times for use by the state and its agents. The state will keep information confidential as provided in AS 38.05.035(a)(9) and its applicable regulations. In accordance with AS 38.05.035(a)(9)(C), in order for geological, geophysical and engineering information submitted under paragraph 11(a) of this lease to be held confidential, the lessee must request confidentiality at the time the information is submitted. The information must be marked **CONFIDENTIAL.**

13. DIRECTIONAL DRILLING. This lease may be maintained in effect by directional wells whose bottom hole location is on the leased area but that are drilled from locations on other lands not covered by this lease. In those circumstances, drilling will be considered to have commenced on the leased area when actual drilling is commenced on those other lands for the purpose of directionally drilling into the leased area. Production of Gas from the leased area through any directional well surfaced on those other lands, or drilling or reworking of that directional well, will be considered production or drilling or reworking operations on the leased area for all purposes of this lease. Nothing contained in this paragraph is intended or will be construed as granting to the lessee any interest, license, easement, or other right in or with respect to those lands in addition to any interest, license, easement, or other right that the lessee may have lawfully acquired from the state or from others.

14. DILIGENCE AND PREVENTION OF WASTE. (a) The lessee shall exercise reasonable diligence in drilling, producing, and operating wells on the leased area unless consent to suspend operations temporarily is granted by the state.

(b) Upon discovery of Gas on the leased area in quantities that would appear to a reasonable and prudent operator to be sufficient to recover ordinary costs of drilling, completing, and producing an

additional well in the same geologic structure at another location with a reasonable profit to the operator, the lessee must drill those wells as a reasonable and prudent operator would drill, having due regard for the interest of the state as well as the interest of the lessee.

(c) The lessee shall perform all operations under this lease in a good and workmanlike manner in accordance with the methods and practices set out in the approved plan of operations and plan of development, with due regard for the prevention of waste of Oil, Gas, and Associated Substances and the entrance of water to the Oil and gas-bearing sands or strata to the destruction or injury of those sands or strata, and to the preservation and conservation of the property for future productive operations. The lessee shall carry out at the lessee's expense all orders and requirements of the State of Alaska relative to the prevention of waste and to the preservation of the leased area. If the lessee fails to carry out these orders, the state will have the right, together with any other available legal recourse, to enter the leased area to repair damage or prevent waste at the lessee's expense.

(d) The lessee shall securely plug in an approved manner any well before abandoning it.

15. OFFSET WELLS. The lessee shall drill such wells as a reasonable and prudent operator would drill to protect the state from loss by reason of drainage resulting from production on other land. Without limiting the generality of the foregoing sentence, if Gas is produced in a well on other land not owned by the state or on which the state receives a lower rate of royalty than under this lease, and that well is within 1,500 feet of lands then subject to this lease, and that well produces Gas for a period of 30 consecutive days in quantities that would appear to a reasonable and prudent operator to be sufficient to recover ordinary costs of drilling, completing, and producing an additional well in the same geological structure at an offset location with a reasonable profit to the operator, and if, after notice to the lessee and an opportunity to be heard, the state finds that production from that well is draining lands then subject to this lease, the lessee shall within 30 days after written demand by the state begin in good faith and diligently prosecute drilling operations for an offset well on the leased area. In lieu of drilling any well required by this paragraph, the lessee may, with the state's consent, compensate the state in full each month for the estimated loss of royalty through drainage in the amount determined by the state.

16. UNITIZATION. (a) The lessee may unite with others, jointly or separately, in collectively adopting and operating under a cooperative or unit agreement for the exploration, development, or operation of the pool, field, or like area or part of the pool, field, or like area that includes or underlies the leased area or any part of the leased area whenever the state determines and certifies that the cooperative or unit agreement is in the public interest.

(b) The lessee agrees, within six months after demand by the state, to subscribe to a reasonable cooperative or unit agreement that will adequately protect all parties in interest, including the state. The state reserves the right to prescribe such an agreement.

(c) With the consent of the lessee, and if the leased area is committed to a unit agreement approved by the state, the state may establish, alter, change, or revoke drilling, producing, and royalty requirements of this lease as the state determines necessary or proper to secure the proper protection of the public interest.

(d) Except as otherwise provided in this subparagraph, where only a portion of the leased area is committed to a unit agreement approved or prescribed by the state, that commitment constitutes a severance of this lease as to the unitized and nonunitized portions of the leased area. The portion of the leased area not committed to the unit will be treated as a separate and distinct lease having the same Effective Date and term as this lease and may be maintained only in accordance with the terms and conditions of this lease, statutes, and regulations. Any portion of the leased area not committed to the unit agreement will not be affected by the unitization or pooling of any other portion of the leased area, by operations in the unit, or by suspension approved or ordered for the unit. If the leased area has a well certified as capable of production in paying quantities on it before commitment to a unit agreement, this lease will not be severed. If any portion of this lease is included in a participating area formed under a unit agreement, the entire leased area will remain committed to the unit and this lease will not be severed.

17. INSPECTION. The lessee shall keep open at all reasonable times, for inspection by any duly authorized representative of the State of Alaska, the leased area, all wells, improvements, machinery, and fixtures on the leased area, and all reports and records relative to operations and surveys or investigations on or with regard to the leased area or under this lease. Upon request, the lessee shall furnish the State of Alaska with copies of and extracts from any such reports and records.

18. SUSPENSION. The state may from time to time direct or approve in writing suspension of production or other operations under this lease.

19. ASSIGNMENT, PARTITION, AND CONVERSION. This lease, or an interest in this lease, may, with the approval of the state, be assigned, subleased, or otherwise transferred in accordance with 11 AAC 82.605 – 11 AAC 82.630.

20. SURRENDER. The lessee at any time may file with the state a written surrender of all rights under this lease in accordance with 11 AAC 82.635.

21. DEFAULT AND TERMINATION; CANCELLATION. (a) The failure of the lessee to perform timely its obligations under this lease, or the failure of the lessee otherwise to abide by all express and implied provisions of this lease, is a default of the lessee's obligations under this lease. Whenever the lessee fails to comply with any of the provisions of this lease (other than a provision which, by its terms, provides for automatic termination), and fails within 60 days after written notice of that default to begin and diligently prosecute operations to remedy that default, the state may terminate this lease if at the time of termination there is no well on the leased area capable of producing Gas in Paying Quantities. If there is a well on the leased area capable of producing Gas in Paying Quantities, this lease may be terminated by an appropriate judicial proceeding. In the event of any termination under this subparagraph, the lessee shall have the right to retain under this lease any and all drilling or producing wells for which no default exists, together with a parcel of land surrounding each well or wells and rights-of-way through the leased area that are reasonably necessary to enable the lessee to drill, operate, and transport Gas from the retained well or wells.

(b) The state may cancel this lease at any time if the state determines, after the lessee has been given notice and a reasonable opportunity to be heard, that:

(1) continued operations pursuant to this lease probably will cause serious harm or damage to biological resources, property, mineral resources, or the environment (including the human environment);

(2) the threat of harm or damage will not disappear or decrease to an acceptable extent within a reasonable period of time; and

(3) the advantages of cancellation outweigh the advantages of continuing this lease in effect. Any cancellation under this subparagraph will not occur unless and until operations under this lease have been under suspension or temporary prohibition by the state, with due extension of the term of this lease, continuously for a period of five years or for a lesser period upon request of the lessee.

(c) Any cancellation under subparagraph (b) will entitle the lessee to receive compensation as the lessee demonstrates to the state is equal to the lesser of:

(1) the value of the cancelled rights as of the date of cancellation, with due consideration being given to both anticipated revenues from this lease and anticipated costs, including costs of compliance with all applicable regulations and stipulations, liability for clean-up costs or damages, or both, in the case of an Oil spill, and all other costs reasonably anticipated under this lease; or

(2) the excess, if any, over the lessee's revenues from this lease (plus interest on the excess from the date of receipt to date of reimbursement) of all consideration paid for this lease and all direct expenditures made by the lessee after the Effective Date of this lease and in connection with exploration or development, or both, under this lease, plus interest on that consideration and those expenditures from the date of payment to the date of reimbursement.

22. RIGHTS UPON TERMINATION. Upon the expiration or earlier termination of this lease as to all or any portion of the leased area, the lessee will be directed in writing by the state and will have the right at any time within a period of one year after the termination, or any extension of that period as may be granted by the state, to remove from the leased area or portion of the leased area all machinery, equipment, tools, and materials. Upon the expiration of that period or extension of that period and at the option of the state, any machinery, equipment, tools, and materials that the lessee has not removed from the leased area or portion of the leased area become the property of the state or may be removed by the state at the lessee's expense. At the option of the state, all improvements such as roads, pads, and wells must either be abandoned and the sites rehabilitated by the lessee to the satisfaction of the state, or be left intact and the lessee absolved of all further responsibility as to their maintenance, repair, and eventual abandonment and rehabilitation. Subject to the above conditions, the lessee shall deliver up the leased area or those portions of the leased area in good condition.

23. DAMAGES AND INDEMNIFICATION. (a) No rights under the AS 38.05.125 reservation may be exercised by the lessee until the lessee has provided to pay the owner of the land, his lessees and permittees, upon which the AS 38.05.125 reserved rights are sought to be exercised, full payment for all damage sustained by the owner by reason of entering the land. If the owner for any reason does not settle the damages, the lessee may enter the land after posting a surety bond determined by the state, after notice and an opportunity to be heard, to be sufficient as to form, amount, and security to secure to the owner, his lessees and permittees, payment for damages, and may institute legal proceedings in a court of competent jurisdiction where the land is located to determine the damages which the owner of the land may suffer. The lessee agrees to pay for any damages that may become payable under AS 38.05.130 and to indemnify the state and hold it harmless from and against any claims, demands, liabilities, and expenses arising from or in connection with such damages. The furnishing of a bond in compliance with this paragraph will be regarded by the state as sufficient provision for the payment of all damages that may become payable under AS 38.05.130 by virtue of this lease.

(b) The lessee shall indemnify the state for, and hold it harmless from, any claim, including claims for loss or damage to property or injury to any person caused by or resulting from any act or omission committed under this lease by or on behalf of the lessee. The lessee is not responsible to the state under this subparagraph for any loss, damage, or injury caused by or resulting from the sole negligence of the state.

(c) The lessee expressly waives any defense to an action for breach of a provision of this lease or for damages resulting from an Oil spill or other harm to the environment that is based on an act or omission committed by an independent contractor in the lessee's employ. The lessee expressly agrees to assume responsibility for all actions of its independent contractors.

24. BONDS. (a) If required by the state, the lessee shall furnish a bond prior to the issuance of this lease in an amount equal to at least $5 per acre or fraction of an acre contained in the leased area, but no less than $10,000, and must maintain that bond as long as required by the state.

(b) The lessee may, in lieu of the bond required under (a) above, furnish and maintain a statewide bond in accordance with applicable regulations.

(c) The state may, after notice to the lessee and a reasonable opportunity to be heard, require a bond in a reasonable amount greater than the amount specified in (a) above where a greater amount is justified by the nature of the surface and its uses and the degree of risk involved in the types of operations being or to be carried out under this lease. A statewide bond will not satisfy any requirement of a bond imposed under this subparagraph, but will be considered by the state in determining the need for and the amount of any additional bond under this subparagraph.

(d) If the leased area is committed in whole or in part to a cooperative or unit agreement approved or prescribed by the state, and the unit operator furnishes a statewide bond, the lessee need not maintain any bond with respect to the portion of the leased area committed to the cooperative or unit agreement.

25. AUTHORIZED REPRESENTATIVES. The Director of the Division of Oil and Gas, Department of Natural Resources, State of Alaska, and the person executing this lease on behalf of the lessee shall be authorized representatives for their respective principals for the purposes of administering this lease. The state or the lessee may change the designation of its authorized representative or the address to which notices to that representative are to be sent by a notice given in accordance with Paragraph 26 below. Where activities pursuant to a plan of operations are underway, the lessee shall also designate, pursuant to a notice under Paragraph 26 below, by name, job title, and address, an agent who will be present in the state during all lease activities.

26. NOTICES; PROTEST. (a) Any notices required or permitted under this lease must be by electronic media producing a permanent record or in writing and must be given personally or by registered or certified mail, return receipt requested, addressed as follows:

TO THE STATE:

DIRECTOR, DIVISION OF OIL AND GAS
DEPARTMENT OF NATURAL RESOURCES
550 WEST 7TH AVENUE, SUITE 800
ANCHORAGE, ALASKA 99501-3560

TO THE LESSEE:

(b) Any notice given under this paragraph will be effective when delivered to the above authorized representative.

(c) A lessee who wishes to protest the amount of money due the state under the lease or any action of the state regarding a provision of this lease must file a written protest with the Division of Oil and Gas within 30 days after the mailing date of the state's notice or bill. A lessee who fails to file a protest within the required time waives any further right to protest. The state will establish the administrative appeal procedure to be followed and will inform the lessee of the procedure no later than 30 days after the filing of the written protest.

27. STATUTES AND REGULATIONS. This lease is subject to all applicable state and federal statutes and regulations in effect on the Effective Date of this lease, and insofar as is constitutionally permissible, to all statutes and regulations placed in effect after the Effective Date of this lease. A reference to a statute or regulation in this lease includes any change in that statute or regulation whether by amendment, repeal and replacement, or other means. This lease does not limit the power of the State of Alaska or the United States of America to enact and enforce legislation or to promulgate and enforce regulations affecting, directly or indirectly, the activities of the lessee or its agents in connection with this lease or the value of the interest held under this lease. In case of conflicting provisions, statutes and regulations take precedence over this lease.

28. INTERPRETATION. This lease is to be interpreted in accordance with the rules applicable to the interpretation of contracts made in the State of Alaska. The paragraph headings are not part of this lease and are inserted only for convenience. The state and the lessee expressly agree that the law of the State of Alaska will apply in any judicial proceeding affecting this lease.

29. INTEREST IN REAL PROPERTY. It is the intention of the parties that the rights granted to the lessee by this lease constitute an interest in real property in the leased area.

30. WAIVER OF CONDITIONS. The state reserves the right to waive any breach of a provision of this lease, but any such waiver extends only to the particular breach so waived and does not limit the rights of the state with respect to any future breach; nor will the waiver of a particular breach prevent cancellation of this lease for any other cause or for the same cause occurring at another time. Notwithstanding the foregoing, the state will not be deemed to have waived a provision of this lease unless it does so in writing.

31. SEVERABILITY. If it is finally determined in any judicial proceeding that any provision of this lease is invalid, the state and the lessee may jointly agree by a written amendment to this lease that, in consideration of the provisions in that written amendment, the invalid portion will be treated as severed from this lease and that the remainder of this lease, as amended, will remain in effect.

32. LOCAL HIRE. The lessee is encouraged to hire and employ local and Alaska residents and companies, to the extent they are available and qualified, for work performed on the leased area. Lessees shall submit, with the plans of operations, a proposal detailing the means by which the lessee will comply with this measure. The lessee is encouraged, in formulating this proposal, to coordinate with employment services offered by the State of Alaska and local communities and to recruit employees from local communities.

33. NONDISCRIMINATION. The lessee and the lessee's contractors and subcontractors may not discriminate against any employee or applicant because of race, religion, marital status, change in marital status, pregnancy, parenthood, physical handicap, color, sex, age, or national origin as set out in AS 18.80.220. The lessee and its contractors and subcontractors must, on beginning any operations under this lease, post in a conspicuous place notices setting out this nondiscrimination provision.

34. ROYALTY ON PRODUCTION. Except for Gas used on the leased area for development and production or unavoidably lost, the lessee shall pay to the state as a royalty 12.50 percent in amount or value of the Gas saved, removed, or sold from the leased area.

35. VALUE. (a) For the purposes of computing royalties due under this lease, the value of royalty Gas shall not be less than the highest of:

(1) the field price received by the lessee for the Gas;

(2) the volume-weighted average of the three highest field prices received by other producers in the same field or area for Gas of like kind and quality at the time the Gas is sold or removed from the leased or unit area or the Gas is delivered to an extraction plant if that plant is located on the leased or unit area; if there are less than three prices reported by other producers, the volume-weighted average will be calculated using the lesser number of prices received by other producers in the field or area;

(3) the lessee's posted price in the field or area for the Gas; or

(4) the volume-weighted average of the three highest posted prices in the same field or area of the other producers in the same field or area for Gas of like kind and quality at the time the Gas is sold or removed from the leased or unit area or the Gas is delivered to an extraction plant if that plant is located on the leased or unit area; if there are less than three prices posted by other producers, the volume-weighted average will be calculated using the lesser number of prices posted by other producers in the field or area.

(b) If Gas is sold away from the leased or unit area, the term “field price” in subparagraph (a) above will be the cash value of all consideration received by the lessee or other producer from the purchaser of the Gas, less the lessee's actual and reasonable costs of transportation away from the leased or unit area to the point of sale. The `actual and reasonable costs of transportation' for marine transportation are as defined in 11 AAC 83.229(a), (b)(2), and (c) – (l).

(c) In the event the lessee does not sell in an arm's-length transaction the Gas, the term "field price" in subparagraphs (a) and (b) above will mean the price the lessee would expect to receive for the Gas if the lessee did sell the Gas in an arm's-length transaction, minus reasonable costs of transportation away from the leased or unit area to the point of sale or other disposition. The lessee must determine this price in a consistent and logical manner using information available to the lessee and report that price to the state.

(d) The state may establish minimum values for the purposes of computing royalties on Gas obtained from this lease, with consideration being given to the price actually received by the lessee, to the price or prices paid in the same field or area for production of like quality, to posted prices, to prices received by the lessee and/or other producers from sales occurring away from the leased area, and/or to other relevant matters. In establishing minimum values, the state may use, but is not limited to, the methodology for determining "prevailing value" as defined in 11 AAC 83.227. Each minimum value determination will be made only after the lessee has been given notice and a reasonable opportunity to be heard. Under this provision, it is expressly agreed that the minimum value of royalty Gas under this lease may not necessarily equal, and may exceed, the price of the Gas.

37. ROYALTY IN VALUE. Except to the extent that the state elects to receive all or a portion of its royalty in kind as provided in Paragraph 38 below, the lessee shall pay to the state that value of all royalty Gas as determined under Paragraph 36 above. Royalty paid in value will be free and clear of all lease expenses (and any portion of those expenses that is incurred away from the leased area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing the Gas for transportation off the leased area. All royalty that may become payable in money to the state must be paid on or before the last federal banking day of the calendar month following the month in which the Gas is produced. The amount of all royalty in value payments which are not paid when due under this lease or the amount which is subsequently determined to be due to the state or the lessee as the result of a redetermination will bear interest from the last federal banking day of the calendar month following the month in which the Gas was produced, until the obligation is paid in full. Interest shall accrue at the rate provided in AS 38.05.135(d) or as may later be amended. Royalty payments must be accompanied by such information relating to valuation of royalty as the state may require which may include, but is not limited to, run tickets, evidence of sales, shipments, and amounts of gross Gas produced.

38. ROYALTY IN KIND. (a) At the state's option, which may be exercised from time to time upon not less than 90 days' notice to the lessee, the lessee shall deliver all or a portion of the state's royalty Gas produced from the leased area in kind. Delivery will be on the leased area, unit area, or at a place mutually agreed to by the state and the lessee, and must be delivered to the State of Alaska or to any individual, firm, or corporation designated by the state.

(b) Royalty Gas delivered in kind must be delivered in good and merchantable condition, of pipeline quality, and free and clear of all lease expenses (and any portion of those expenses incurred away from the leased area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing the Gas for transportation off the leased area.

(c) After having given notice of its intention to take, or after having taken its royalty Gas in kind, the state, at its option and upon 90 days' notice to the lessee, may elect to receive a different portion or none of its royalty in kind. If, under federal regulations, the taking of royalty Gas in value by the state creates a

supplier-purchaser relationship, the lessee hereby waives its right to continue to receive royalty Gas under that relationship, and further agrees that it will require any purchasers of the royalty Gas likewise to waive any supplier-purchaser rights.

(d) The lessee shall furnish storage for royalty Gas produced from the leased or unit area to the same extent that the lessee provides storage for the lessee's share of Gas. The lessee shall not be liable for the loss or destruction of stored royalty Gas from causes beyond the lessee's ability to control.

(d) If a state royalty purchaser refuses or for any reason fails to take delivery of Gas in an emergency, and with as much notice to the lessee as is practical or reasonable under the circumstances, the state may elect without penalty to underlift for up to six months all or a portion of the state's royalty on Gas produced from the leased or unit area and taken in kind. The state's right to underlift is limited to the portion of royalty Gas that the royalty purchaser refused or failed to take delivery of, or the portion necessary to meet the emergency condition. Underlifted Gas may be recovered by the state at a daily rate not to exceed 10 percent of its royalty interest share of daily production at the time of the underlift recovery.

39. REDUCTION OF ROYALTY. Lessee may request a reduction of royalty in accordance with the applicable statutes and regulations in effect on the date of application for the reduction.

40. DEFINITIONS. All words and phrases used in this lease are to be interpreted where possible in the manner required in respect to the interpretation of statutes by AS 01.10.040. However, the following words have the following meanings unless the context unavoidably requires otherwise:

(1) "Effective Date" of this lease means the first day of the month following the date on which the lease was signed on behalf of the state or, upon prior writtten request, the first day of the month in which it was signed on behalf of the state.

(4) "Force Majeure" means war, riots, acts of God, unusually severe weather, or any other cause beyond the lessee's reasonable ability to foresee or control and includes operational failure of existing transportation facilities and delays caused by judicial decisions or lack of them

(5) "Gas" means all natural gas (except helium gas) and all other hydrocarbons produced that are not defined in this lease as oil;

(6) "Notice" means notification given in conformance with 11 AAC 88.140.

(7) "Oil" means crude petroleum oil and other hydrocarbons, regardless of gravity, that are produced in liquid form by ordinary production methods, including liquid hydrocarbons known as distillate or condensate recovered by separation from gas other than at a gas processing plant; and

(8) “Paying Quantities” has the meanings contained in 11 AAC 83.105.

BY SIGNING THIS LEASE, the state as lessor and the lessee agree to be bound by its provisions.

STATE OF ALASKA

By: _____ Date: _____
Kevin R. Banks
Director, Division of Oil and Gas

STATE OF ALASKA)
) ss.
Third Judicial District)

On , before me appeared Kevin R. Banks of the Division of Oil and Gas of the State of Alaska, Department of Natural Resources, and who executed this lease and acknowledged voluntarily signing it on behalf of the State of Alaska as lessor.

_____
Notary public in and for the State of Alaska
My commission expires

LESSEE: _____ Date: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LESSEE'S SIGNATURE HERE.

LESSEE: _____ Date: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LESSEE'S SIGNATURE HERE.