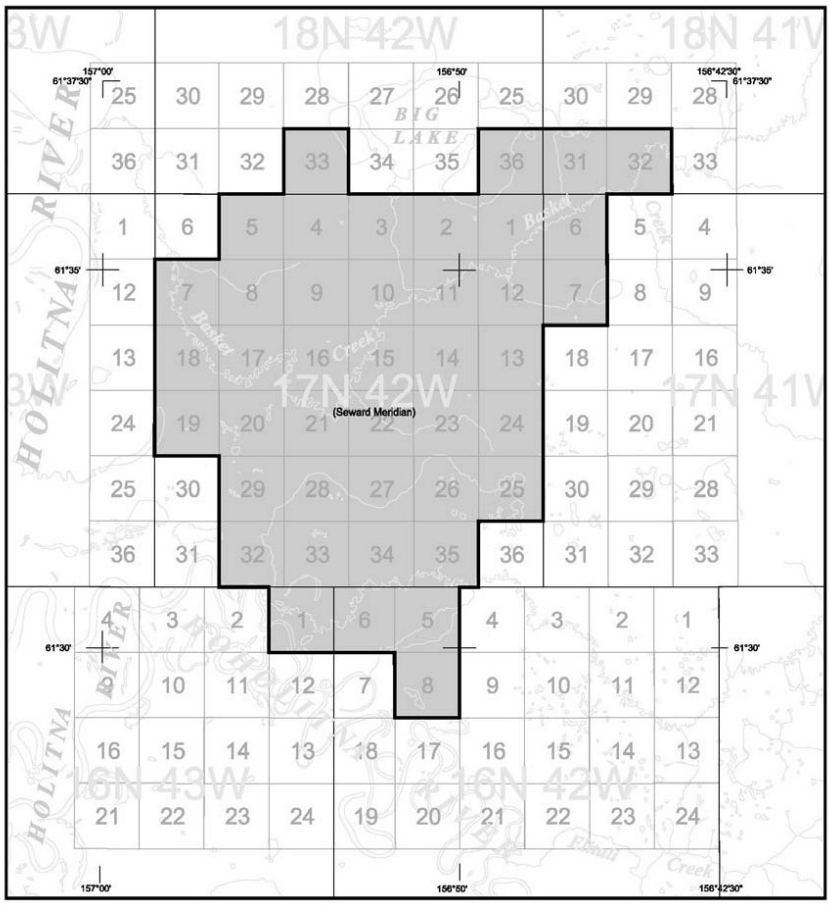
December 9, 2009

HOLITNA BASIN EXPLORATION LICENSE

Final Finding of the Director on Remand



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DIVISION OF OIL & GAS

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

December 9, 2009

Table of Contents

Page

Chapter One: Executive Summary and Introduction 1-1
A. Executive Summary 1-1
1. Background 1-1
2. Decision 1-1
B. Introduction 1-2
1. Exploration Licensing 1-2
2. Best Interest Findings 1-3
a. Scope of Review 1-3
b. Phased Review 1-4
c. Preliminary Finding and Public Process 1-5
d. Final Best Interest Finding 1-5
e. Request for Reconsideration and Appeal to Superior Court 1-5
3. History and Status of the Holitna Exploration License 1-6
a. Exploration License Application 1-6
b. Best Interest Finding Process 1-6
i. Phasing 1-6
ii. Scope of Review 1-8
iii. Preliminary Finding and Public Process 1-8
iv. Final Finding 1-9
v. Request for Reconsideration and Remand 1-9
vi. Reconsideration 1-9
C. Governmental Powers to Regulate Gas Exploration, Development, Production, and Transportation 1-10
1. Alaska Department of Natural Resources 1-10
a. Plan of Operation Approval 1-10
b. Geophysical Exploration Permit 1-11
c. Pipeline Rights-of-Way 1-12
d. Temporary Water Use Authorization 1-12
e. Permit and Certificate to Appropriate Water 1-12
f. Land Use Permits 1-13
g. Material Sale Contract 1-13
h. Office of History and Archaeology 1-14
2. Alaska Department of Environmental Conservation 1-14
a. Air Quality Permits 1-14
i. Title I (NSR) Construction Permits 1-15
ii.Title V Operation Permits 1-16
b. Solid Waste Disposal Permit 1-16
c. Wastewater Disposal Permit 1-17
d. NPDES Certification 1-17
e. U.S. Army Corps of Engineers Section 10 and Section 404 Permit Certification 1-18
f. Oil Discharge Prevention and Contingency Plan 1-18
3.Alaska Department of Fish and Game 1-18
a. Waters Important to Anadromous Fish and Fish Passage 1-18
4.Alaska Oil and Gas Conservation Commission 1-18
a. Permit to Drill 1-19
i. Permit Description 1-19
ii. Review Process 1-19
b. Disposal of Wastes 1-19

Table of Contents (continued)

Page

c. Annular Injection 1-20
d. Review Process 1-20
5. State and Local Fire and Building Safety Offices 1-20
6. U.S. Environmental Protection Agency 1-20
a. Air Quality Permits 1-20
b. Hazardous Waste (RCRA) Permits 1-21
c. NPDES Permit 1-21
i. Permit Description 1-21
ii. Review Process 1-22
d. UIC Class I and II Injection Well Permits 1-22
e. Spill Response Plan (C-Plan) 1-22
7. U.S. Army Corps of Engineers 1-23
a. Section 10 and Section 404 Permits 1-23
i. Permit Description 1-23
ii. Review Process 1-23
8. Pipeline and Hazardous Materials Safety Administration 1-24
9. Other Requirements 1-24
a. Native Allotments 1-24
b. Rehabilitation Following Lease Expiration 1-24
c. Applicable Laws and Regulations 1-24

Chapter Two: Property Description, Geology, and Petroleum 2-1
A. Property Description 2-1
B. Geology and Petroleum Potential 2-3

Chapter Three: Habitat, Fish, and Wildlife of the Holitna Basin 3-1
A. Habitat 3-1
1. Vegetation 3-3
2. Wetlands and Aquatic Plants 3-7
B. Fish and Wildlife Populations 3-10
1. Fish 3-10
2. Birds 3-13
a. Waterfowl 3-13
b. Cranes 3-16
c. Raptors 3-16
3. Terrestrial Mammals 3-17
a. Caribou 3-17
b. Moose 3-17
c. Brown Bears 3-19
d. Black Bears 3-19
e. Wolves 3-19
f. Furbearers 3-19
4. Threatened and Endangered Species 3-20

Chapter Four: Current and Projected Uses of the Holitna Basin License Area 4-1
A. Kuskokwim Area Plan 4-1
B. Boroughs or Census Areas and Communities Within and Near the License Area 4-1
1. Bethel Census Area 4-1

Table of Contents (continued)

Page

2. Aniak 4-1
3. McGrath 4-3
4. Crooked Creek 4-3
5. Chuathbaluk 4-3
6. Sleetmute 4-4
7. Takotna 4-4
8. Stony River 4-4
9. Red Devil 4-5
10. Lime Village 4-5
11. Georgetown 4-5
12. Napaimute 4-5

C. Subsistence 4-5
D. Sport Harvest Activities 4-11
1. Hunting and Trapping 4-11
2. Sport Fishing 4-15
E. Tourism 4-15

Chapter Five: Reasonably Foreseeable Effects of Licensing and Subsequent Activity 5-1
A. Post-Licensing Phases 5-2
1. Exploration 5-3
a. Geophysical Exploration 5-3
b. Exploration Drilling 5-3
2. Development and Production 5-5
B. Statewide and Local Fiscal Effects 5-8
1. Statewide Fiscal Effects 5-8
2. Local Fiscal Effects 5-9
a. Employment 5-10
b. Cost of Living 5-12
C. Municipal and Community Effects 5-13
1. Commercial Fishing 5-13
2. Infrastructure 5-13
3. Land Use 5-13
D. Cumulative Effects 5-14
1. Effects on Water Quality 5-14
2. Effects on Air Quality 5-17
3. Effects on Fish and Wildlife Habitat and Populations and Their Uses 5-17
a. Terrestrial Habitat 5-17
b. Effects on Fish 5-19
c. Effects on Birds 5-20
d. Effects on Terrestrial Wildlife 5-22
i. Caribou and Moose 5-22
ii. Bears 5-23
iii. Wolves 5-23
iv. Furbearers and Other Small Mammals 5-23
v. Mitigation Measures 5-24
4. Effects on Subsistence Uses 5-24
5. Effects on Cultural and Historic Resources 5-24

Table of Contents (continued)

Page

Chapter Six: Specific Issues Related to Geophysical Hazards and Gas Transportation 6-1
A. Geophysical Hazards 6-1
1. Earthquakes and Faults 6-1
2. Volcanoes 6-1
3. Flood Hazards 6-2
4. Permafrost 6-4
5. Summary 6-5
B. Transportation 6-5
1. Pipelines and Their Components 6-5
a. Pipe 6-5
b. Compressor Stations 6-5
c. Metering Stations 6-6
d. Valves 6-6
e. Buried Pipelines 6-6
C. Gas Release and Oil Spill Risk, Prevention, and Response 6-6
1. Gas Release and Oil Spill Risk 6-6
2. Prevention and Response 6-6

Chapter Seven: Mitigation Measures and Licensee Advisories 7-1
A. Mitigation Measures 7-1
1. Facilities and Operations 7-1
2. Fish and Wildlife Habitat 7-2
3. Subsistence, Commercial, and Sport Harvest Activities 7-3
4. Fuel, Hazardous Substances and Waste 7-3
5. Access 7-4
6. Prehistoric, Historic, and Archeological Sites 7-5
7. Local Hire, Communication, and Training 7-5
8. Definitions 7-5
B. Licensee Advisories 7-6
1. ADF&G 7-6
2. ADEC 7-6
3. USCOE 7-7
4. USFWS 7-7

Chapter Eight: Reconsideration, Decision, and Signatures 8-1
A. Reconsideration 8-1
1. Purpose of Exploration Licenses 8-1
2. Points Raised by HEC 8-2
a. Coal Bed Methane 8-3
b. Size of License Area and Mitigation Measures 8-3
c. Community Support 8-4
3. Matters Required by AS 38.05.133(f) and AS 38.05.035(e) and (g) 8-5
a. Property Description and Petroleum Potential 8-5
b. Fish, Wildlife, and Habitats 8-6
c. Current and Projected Uses 8-6
d. Governmental Powers 8-7
e. Reasonably Foreseeable Cumulative Effects and Mitigation Measures 8-7

Table of Contents (continued)

Page

i. Water 8-7
ii. Air 8-7
iii. Fish and Wildlife Habitats and Populations 8-7
iv. Uses of Fish and Wildlife Habitats and Populations 8-9
v. Archeological, Cultural, and Historic Resources 8-9
f. Statewide and Local Fiscal Effects and Mitigation Measures 8-9
g. Municipal and Community Effects and Mitigation Measures 8-10
h. Other Considerations 8-11
i. Geophysical Hazards 8-11
ii. Likely Methods of Transportation 8-11
B. Final Best Interest Finding Decision on Remand 8-12

Appendix A: Summary of Comments and Responses A-1
A. Common Issues A-1
B. Individual Comments A-6

Appendix B: Laws and Regulations Pertaining to Oil and Gas Exploration, Development, Production, and Transportation B-1

Appendix C: Directional and Extended-Reach Drilling C-1

Appendix D: Coalbed Methane Wells D-1

Appendix E: References E-1

Appendix F: Sample Exploration License F-1

List of Tables

Table		Page
Table 2.1.	Geologic time.	2-3
Table 3.1.	Vegetation classes in the Holitna Basin license area.	3-4
Table 3.2.	Plant species within or adjacent to the Holitna Basin license area.	3-9
Table 3.3.	Wetland vegetation classes in the Holitna Basin license area.	3-9
Table 3.4.	Anadromous and resident fish of the Holitna Basin.	3-10
Table 3.5.	Anadromous and resident fish streams within or adjacent to the Holitna Basin license area.	3-11
Table 3.6.	Historical salmon escapement for the Kogrukluk River weir, 1994-2004.	3-13
Table 3.7.	Bird observations within or adjacent to the Holitna license area, 1959-2004.	3-14
Table 3.8.	Bird observations in the Holitna Basin area.	3-14
Table 4.1.	Subsistence harvests from communities of the Holitna Basin area, by category.	4-9
Table 4.2.	Escapements of Chinook, chum, and coho salmon to the Holitna River, 2001-2003.	4-11
Table 4.3.	Harvests of the Mulchatna caribou herd in GMUs 9B, 17, 18 south, 19A, and 19B, 1992-2002.	4-12
Table 4.4.	Caribou harvests from the McGrath area, by herd, for GMUs 19A-D, 21A, and 21E, 1989-2002.	4-12
Table 4.5.	Reported moose harvest, by residency, in GMUs 19A and 19B, 1994-2003.	4-13
Table 4.6.	Harvest of brown bear in GMU 19, by subunit, 1989-2000.	4-13
Table 4.7.	Harvest of wolves in GMU 19, by subunit, 1985-2002.	4-14
Table 4.8.	Harvest of furbearers in GMU 19, by subunit, 1995-2000.	4-14
Table 4.9.	Sport fish harvest and effort, by species, on the Holitna River, 1990-2000.	4-15
Table 5.1.	Potential activities and effects of gas exploration, development, and production.	5-2
Table 5.2.	Some examples of exploration, development, and production phase activities.	5-2
Table 5.3.	Drilling fluid additives.	5-5
Table 5.4.	Average monthly employment in the Bethel census area.	5-10
Table 5.5.	Cost of living comparison for Bethel and Anchorage.	5-13

List of Figures

Figure		Page
Figure 1.1.	Holitna Basin exploration license area.	1-7
Figure 2.1.	Bethel Census Area.	2-1
Figure 2.2.	General land status of the Holitna Basin.	2-2
Figure 2.3.	Geology of the Holitna Basin.	2-4
Figure 3.1.	Location of the Holitna exploration license area relative to Management Area 15: Holitna River, subunits 15A and 15C, of the Kuskokwim Area Plan.	3-2
Figure 3.2.	Vegetation types of the Holitna Basin.	3-8
Figure 3.3.	Anadromous fish streams of the Holitna Basin.	3-12
Figure 3.4.	Distribution of ducks and geese in the Holitna Basin area.	3-15
Figure 3.5.	ADF&G Game Management Units of the Holitna Basin area.	3-18
Figure 4.1.	Boroughs or census areas and communities of the Holitna Basin.	4-2
Figure 4.2.	Subsistence uses in the Holitna Basin area.	4-8
Figure 4.3.	Harvest of wild foods in Alaska, by census area.	4-9
Figure 4.4.	Subsistence salmon harvests during 1989-2000, Kuskokwim River communities, Bethel Census Area.	4-10
Figure 5.1.	Evolving consolidation of North Slope production pad size.	5-6
Figure 5.2.	Drill site block diagram.	5-7
Figure 5.3.	Directional drilling applications.	5-7
Figure 5.4.	Average monthly unemployment rate in the Bethel Census Area and Alaska, 2004.	5-12
Figure 5.5.	Per capita personal income, 1979-2002.	5-12
Figure 6.1.	Volcano and historic earthquake epicenter locations.	6-3
Figure C.1	Multilateral wellbore completions.	C-3
Figure C.2	Well reach versus time (in Alaska)	C-3
Figure D.1.	Cross section of a typical coalbed methane well.	D-1

Chapter One: Executive Summary and Introduction

Table of Contents

Page

A. Executive Summary 1-1
1. Background 1-1
2. Decision 1-1
B. Introduction 1-2
1. Exploration Licensing 1-2
2. Best Interest Findings 1-3
a. Scope of Review 1-3
b. Phased Review 1-4
c. Preliminary Finding and Public Process 1-5
d. Final Best Interest Finding 1-5
e. Request for Reconsideration and Appeal to Superior Court 1-5
3. History and Status of the Holitna Exploration License 1-6
a. Exploration License Application 1-6
b. Best Interest Finding Process 1-6
i. Phasing 1-6
ii. Scope of Review 1-8
iii. Preliminary Finding and Public Process 1-8
iv. Final Finding 1-9
v. Request for Reconsideration and Remand 1-9
vi. Reconsideration 1-9
C. Governmental Powers to Regulate Gas Exploration, Development, Production, and Transportation 1-10
1. Alaska Department of Natural Resources 1-10
a. Plan of Operation Approval 1-10
b. Geophysical Exploration Permit 1-11
c. Pipeline Rights-of-Way 1-12
d. Temporary Water Use Authorization 1-12
e. Permit and Certificate to Appropriate Water 1-12
f. Land Use Permits 1-13
g. Material Sale Contract 1-13
h. Office of History and Archaeology 1-14
2. Alaska Department of Environmental Conservation 1-14
a. Air Quality Permits 1-14
i. Title I (NSR) Construction Permits 1-15
ii. Title V Operation Permits 1-16
b. Solid Waste Disposal Permit 1-16
c. Wastewater Disposal Permit 1-17
d. NPDES Certification 1-17
e. U.S. Army Corps of Engineers Section 10 and Section 404 Permit Certification 1-18
f. Oil Discharge Prevention and Contingency Plan 1-18
3. Alaska Department of Fish and Game 1-18
a. Waters Important to Anadromous Fish and Fish Passage 1-18

Table of Contents (continued)

Page

4. Alaska Oil and Gas Conservation Commission 1-18
   a. Permit to Drill 1-19
      i. Permit Description 1-19
      ii. Review Process 1-19
   b. Disposal of Wastes 1-19
   c. Annular Injection 1-20
   d. Review Process 1-20
5. State and Local Fire and Building Safety Offices 1-20
6. U.S. Environmental Protection Agency 1-20
   a. Air Quality Permits 1-20
   b. Hazardous Waste (RCRA) Permits 1-21
   c. NPDES Permit 1-21
      i. Permit Description 1-21
      ii. Review Process 1-22
   d. UIC Class I and II Injection Well Permits 1-22
   e. Spill Response Plan (C-Plan) 1-22
7. U.S. Army Corps of Engineers 1-23
   a. Section 10 and Section 404 Permits 1-23
      i. Permit Description 1-23
      ii. Review Process 1-23
8. Pipeline and Hazardous Materials Safety Administration 1-24
9. Other Requirements 1-24
   a. Native Allotments 1-24
   b. Rehabilitation Following Lease Expiration 1-24
   c. Applicable Laws and Regulations 1-24

List of Figures

Figure **Page**

Figure 1.1. Holitna Basin exploration license area 1-7

Chapter One: Executive Summary and Introduction

A. Executive Summary

1. Background

On remand, the Alaska Department of Natural Resources (ADNR), Division of Oil and Gas (DO&G) reevaluates a gas only exploration license proposal for the Holitna basin under the oil and gas exploration license program set out at AS 38.05.131-.134. Holitna Energy Co., LLC (HEC) initiated a proposal for a gas only exploration license for 26,791 acres in the Holitna area (Holitna exploration license) from ADNR under this program. Before issuing an exploration license, ADNR must issue a written finding that concludes that the state's best interests would be served (AS 38.05.133(f), and AS 38.05.035(e) and (g)).

In its August 1, 2005 preliminary best interest finding (preliminary finding), ADNR preliminarily concluded that HEC's exploration license proposal would best serve the interests of the State of Alaska. In its final best interest finding (final finding) issued October 2, 2006, the division concluded that the project was not in the state's best interest because the small size of the license area would make it difficult to condition the license in a manner that allowed exploration activities to occur harmoniously with the other uses in the area and without impact to sensitive fish and wildlife resources. ADNR also concluded that the license was not in the state's best interest because the project had very little local support and the project proponent had not proactively garnered such support.

On October 5, 2006, HEC asked the ADNR Commissioner to reconsider the final finding, under ADNR's appeal regulations (11 AAC 02.010 et seq.), and requested time to submit additional information. HEC submitted the additional information on November 20, 2006. The request for reconsideration was granted on November 28, 2006. On June 20, 2007, the commissioner affirmed the final finding denying HEC the exploration license.

On July 20, 2007, HEC appealed ADNR's decision to superior court, arguing that ADNR's decision with respect to the final best interest finding, and its denial of HEC's request for reconsideration, lacked a reasonable basis, and failed to show that ADNR gave the requisite "hard look" at all the salient facts and issues raised. HEC asked the court to remand the case to ADNR.

On March 18, 2008, ADNR submitted an unopposed motion to remand HEC's appeal, saying that it had reviewed HEC's opening brief, and based on that review, requested that the court remand this case to ADNR so that the commissioner may reexamine the facts and conclusions in both the final finding and his decision on reconsideration. On March 19, 2008, the court remanded the case to ADNR.

2. Decision

This document provides the commissioner's reconsideration and discussion of matters required by AS 38.05.133(f), and AS 38.05.035(e) and (g); his reconsideration of points raised by HEC in its request for reconsideration; and the commissioner's decision on remand that issuing a gas only exploration license to HEC is in the state's best interest.

B. Introduction

1. Exploration Licensing

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, art. VIII, §§ 1, 2). To comply with this provision, the Legislature enacted Title 38 of the Alaska Statutes (AS 38.04.005, et seq.) and directed ADNR to implement the statutes.

Alaska Statutes 38.05.035 and 38.05.131-134 govern the issuance of an exploration license and include the public notice requirements referred to in this document, in accordance with AS 38.05.945. Under AS 38.05.035(e), ADNR may not dispose of state land, resources, property, or interests, unless the director first determines in a written finding that such action will serve the best interests of the state.

Exploration licensing supplements the state's conventional oil and gas leasing program by targeting areas outside 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 some of 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 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 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 submittal 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 because, prior to any exploration activity taking place, the proposed activity must go through the permitting processes described in Section C of this chapter.

Within 30 days after receiving a proposal for an exploration license, the commissioner must either reject it in a written decision or give public notice of ADNR'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 staff develop a preliminary finding as to whether issuing a license is in the state's best interests (see below for more details of this process). The public has 60 days to review and comment on the preliminary finding. Under AS 38.05.035(e)(7)(B), best interest findings must include a summary of agency and public comments received regarding the disposal, as well as an ADNR response. Appendix A provides a summary of public comments and ADNR's responses.

House Bill 531, passed in the 2004 legislative session, eliminated the original shallow gas leasing program that had been in effect since 1995, and expanded existing oil and gas leasing programs to include nonconventional gas leasing and exploration licenses. HB 531 also authorized applicants under the previous program to convert pending shallow natural gas lease applications to noncompetitive exploration license applications.

2. Best Interest Findings

Alaska statutes govern the disposal of state-owned mineral interests. AS 38.05.035(e) says 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 it describes the license 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. ADNR, 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 period allowed for receipt of public comment.

AS 38.05.035(e) prescribes what, at minimum, must be in these findings. AS 38.05.035(g)(1)(B) lists the following matters that DO&G must consider and discuss in its written finding:

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 oil and gas exploration, development, production, and transportation;

vi. the reasonably foreseeable cumulative effects of oil and gas exploration, development, production, and transportation on the license area, including effects on subsistence uses, fish and wildlife habitat and populations and their uses, and historic and cultural resources;

vii. license and subsequent lease stipulations and mitigation measures, including any measures to prevent and mitigate releases of oil and hazardous substances, to be included in the license and any subsequent leases, 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 area, and the advantages and disadvantages and relative risks of each;

ix. the reasonably foreseeable fiscal effects of the exploration license and the subsequent activity on the state and affected municipalities and communities, including the explicit and implicit subsidies associated with the license, if any; and

x. the reasonably foreseeable effects of oil and gas exploration, development, production, and transportation on the municipalities and communities within or adjacent to the license area.

Other laws and regulations applicable to gas activities in Alaska can be found in Appendix B.

a. Scope of Review

The scope of review for best interest findings is based upon the facts and issues known, or made known, to the director. The scope of the finding may address only reasonably foreseeable, significant effects of the proposed uses to be authorized by the disposal (AS 38.05.035(e)(1)(A)). 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.

These constraints eliminate speculation about potential but improbable future effects and focus the best interest finding on those effects most likely to occur as a result of the proposed disposal. For example, at the time ADNR prepares a best interest finding, it is unknown whether, when, and where development or production, or related facilities might result. This concept is codified in AS 38.05.035(h), which provides that "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." 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, according to AS 38.05.035(e)(1)(B) 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.

b. Phased Review

Phased review allows the analysis of licensing to focus only on the issues pertaining to the licensing phase and the reasonably foreseeable 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 is addressed in Section C below and in AS 38.05.035(e)(1)(C).

Under AS 38.05.035(e)(1)(C), ADNR is allowed to review projects as "multiphased development," when the following conditions are met:

(i) the only uses to be authorized by the proposed 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);

(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.

Phased review is based, in part, on the fact that some multiphased projects are subject to continued review throughout the succeeding phases, and the future phases cannot be reviewed with any reliability when information regarding potential future phases is nonspecific, undefined, unavailable, or unreliable.

c. Preliminary Finding and Public Process

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

To obtain public comments, a preliminary best interest finding is issued and is public noticed with a request for comments. The public has 60 days to review and comment on the preliminary finding. DO&G follows the public notice statute, AS 38.05.945. This statute includes specific requirements for notice given by ADNR for a written finding under AS 38.05.035(e):

- Publication of a legal notice and display ad 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 provided to municipalities, Alaska Native Claims Settlement Act (ANCSA) corporations, postmasters (for public posting), and nonprofit community organizations in the area of the license that have requested notification in writing. AS 38.05.946 provides that a municipality or an ANCSA corporation may hold a hearing, which the commissioner or his representative shall attend. The commissioner may also, at his discretion, 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 to issue an exploration license; establishing the scope of the review for that decision by determining the reasonably foreseeable, significant effects of licensing and subsequent leasing that arise from those material facts and issues; and balancing those effects to determine under what conditions, if any, issuing an exploration license for the area will serve the best interests of the state.

Under AS 38.05.035(e) (7), best interest findings must include a summary of agency and public comments regarding the proposed disposal and an ADNR response.

d. 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 exploration license is in the best interest of the state, and makes a final finding.

e. Request for Reconsideration and Appeal to Superior Court

After a final best interest finding is issued, 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. 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)).

3. History and Status of the Holitna Exploration License

a. Exploration License Application

On May 6, 2003, HEC applied to ADNR for shallow gas leases in the Holitna Basin, under the Shallow Gas Leasing program. These leases would have allowed HEC to conduct seismic work and drill for any gas accumulations that exist, within 3,000 ft of the surface.

On January 1, 2004, the Shallow Gas Leasing Program was repealed, with a provision allowing an applicant to convert pending shallow natural gas leases to a noncompetitive exploration license. On July 2, 2004, HEC submitted a request to convert shallow natural gas applications ADL 390390 through 390394 and 390605 to an exploration license application. The application is for a gas only exploration license for the Holitna Basin, located within the Seward Meridian (Figure 1.1). Affected communities include Stony River, Red Devil, Sleetmute, Crooked Creek, Aniak, and, to a lesser extent, communities of the central Kuskokwim region.

The legal description of the license area is as follows:

T. 18N., R. 42W., Sections 33 and 36
T. 18N., R. 41W., Sections 31 and 32
T. 17N., R. 42W., Sections 1 thru 5, 7 thru 29, and 32 thru 35
T. 17N., R. 41W., Sections 6 and 7
T. 16N., R. 43W., Section 1
T. 16N., R. 42W., Sections 5, 6, and 8.

b. Best Interest Finding Process

i. Phasing

In evaluating the exploration license proposal, it was determined the review of activities in the license area is a multiphased development review. Under AS 38.05.035(e)(1)(C), the conditions under which phasing may occur have been met. Therefore, the scope of the finding is limited to the applicable statutes and regulations, facts, and issues that pertain solely to the disposal phase of gas exploration licensing and the reasonably foreseeable effects of issuing an exploration license.

Condition (i) is met because the only proposed uses to be authorized are part of the licensing phase. A license only gives the licensee, subject to the provisions of the license, the nonexclusive 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. The license itself does not authorize any exploration, development, or production activities.

Condition (ii) is met because ADNR will be required to provide public notice and opportunity to comment for any proposed plan of operations in the Holitna Basin license area.

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

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

The effects of future exploration, development, and production will be considered at each subsequent phase, when various government agencies and the public review applications for specific proposed activities at specific locations. However, the finding does discuss, in general terms, the potential effects that may occur with gas exploration, development, production, and transportation within the license area, as well as measures to be imposed as terms of the license, subsequent permit, and plan of operations to mitigate possible adverse effects.

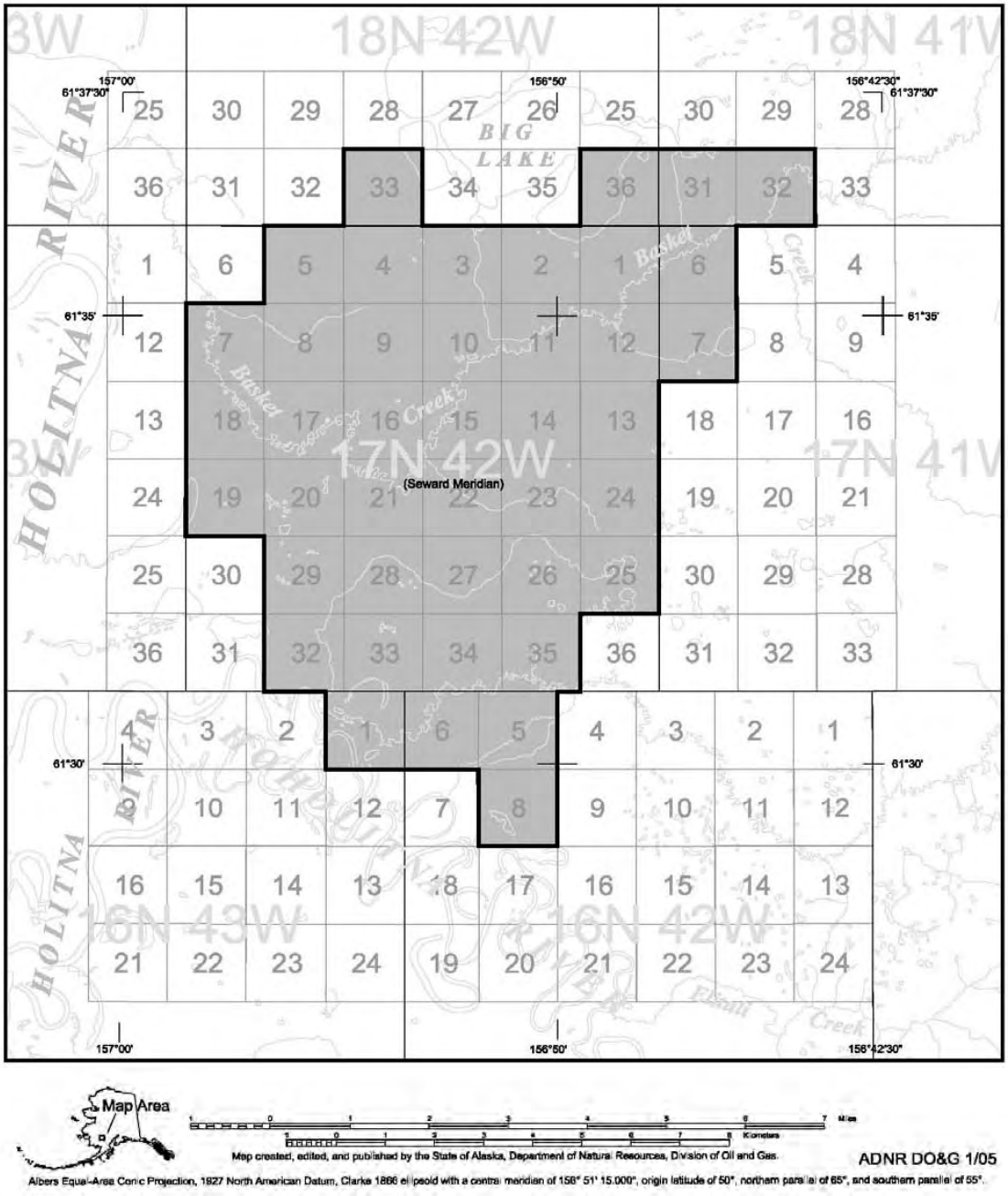


Figure 1.1. Holitna Basin exploration license area.

ii. Scope of Review

The scope of review in the finding is limited to the applicable statutes and regulations, the material facts and issues that are known to the director and that pertain to the issuance phase, and the reasonably foreseeable, significant effects of licensing. This includes items required by AS 38.05.035(g)(1)(B)(i)-(x), all material facts and issues expressed by the public during the public comment period, and the basis for the director's final finding, that, on balance, issuing the exploration license would be in the state's best interest. A discussion of the possible specific effects of unknown future exploration, development, and production activities is not within the scope of the finding. However, the finding does discuss, in general terms, the potential effects of gas exploration, development, production, and transportation within the license area.

iii. Preliminary Finding and Public Process

On October 22, 2004, DO&G issued a *Notice of Intent to Evaluate a Gas Only Exploration License Proposal and Request for Competing Proposals*. In the same notice, DO&G issued a *Call for Comments* request on the proposed exploration license, and the public was given 60 days in which to comment. The comment period began on October 22, 2004 and ended on December 21, 2004.

Several comments were received prior to July 2004, at the time when the shallow natural gas applications were pending. These comments all requested more information and more time to provide public comment. With the repeal of the shallow natural gas leasing program and the conversion of HEC's shallow natural gas application to an exploration license proposal for gas only exploration, a new public process was initiated, which responded to these early requests for additional information and time for public comment.

Numerous comments were received in response to the call for comments issued on October 22, 2004, many of which expressed strong support for the proposed gas only exploration license. Comments opposed to the license primarily addressed environmental and subsistence concerns, with additional comment on the administrative process used to implement HB 531 and the adequacy of public notice. Appendix A provides a summary of the public comments and ADNR's responses.

While preparing the preliminary best interest finding, DO&G staff attended meetings in the Holitna region, specifically in Sleetmute (March 14, 2005) and in Crooked Creek and Aniak (March 15, 2005). During these meetings, DO&G staff presented information on the license and on the public process involved in evaluating an exploration license proposal. At the meetings, in telephone conversations, and in letters, residents of the communities, Native elders, and tribal council members expressed opinions and concerns about the proposed exploration license.

On August 1, 2005, DO&G issued a preliminary finding in which the director concluded that the proposed license served the state's best interest. The preliminary finding included mitigation measures intended to minimize impacts and enhance the positive aspects of the proposed exploration license. The preliminary finding was subject to revision based on comments received during the 60-day public comment period.

During the 60-day public comment period for the preliminary finding, DO&G accepted both written and oral comments. DO&G staff attended meetings in Aniak and Sleetmute (September 26, 2005), Crooked Creek and Red Devil (September 27, 2005), and Bethel (September 28, 2005). During this comment period, most of the comments expressed strong opposition to the proposed license, and DO&G received significant comments on the proposed mitigation measures. Among the concerns expressed was the potential for impact to local subsistence resources, including disturbance of fish, moose and caribou and their habitats, and potential pollution of surface and subsurface water resources. Residents also expressed concern about possible disturbance to the license area's historical and cultural artifacts, and the possibility of local gas resources being provided to nonlocal users while local energy costs are high. The division worked with local Native leaders to identify

local landmarks and gather traditional knowledge about the license area. The division also consulted with the Division of Parks and Outdoor Recreation, Office of History and Archaeology to identify any reported archaeological sites in the license area.

iv. Final Finding

On October 2, 2006, the division issued a final best interest finding that included a summary of all comments received and responses to the comments. The final finding concluded that the Holitna exploration license was not in the state's best interest because the small size of the license area would make it difficult to condition the license in a manner that allowed exploration activities to occur harmoniously with the other uses in the area and without impact to sensitive fish and wildlife resources, and because the project had very little local support and the project proponent had not proactively garnered such support.

v. Request for Reconsideration and Remand

On October 5, 2006, HEC requested that the commissioner reconsider the final finding, under ADNR's appeal regulations (11 AAC 02), and requested an additional 30 days to submit additional information. On October 6, 2006, the commissioner allowed that HEC could submit, no later than October 20, 2006, additional justification to support the 30-day extension request.

On October 20, 2009, HEC submitted additional justification to support the request for the 30 day extension to request reconsideration. On October 23, 2006, the commissioner granted HEC's request to extend the time period for requesting reconsideration until November 20, 2006.

On November 20, 2006, HEC submitted a request that the commissioner reconsider the October 2, 2006 decision to deny the Holitna Basin exploration license application. Additional materials for the commissioner to consider accompanied the request. The commissioner granted the request for reconsideration on November 28, 2006.

In the additional information submitted by HEC on November 20, 2006, HEC relinquished its rights to coal bed methane (CBM); HEC disagreed with ADNR's conclusion that due to the small size of the proposed license area, mitigation measures would not be protective of fish and wildlife habitat; HEC committed to working with local community representatives to identify specific and workable project design, scheduling, and operation standards that minimize impacts to fish and wildlife and their habitats, as well as subsistence uses; and HEC stated its belief that local support will balloon by removing CBM concerns, by working with locals to protect fish and game populations and habitats as well as subsistence uses of fish and game, and also by committing to hiring locally.

On June 20, 2007, the commissioner affirmed the final finding denying HEC the exploration license. On July 20, 2007, HEC appealed the commissioner's decision to deny the application to superior court, arguing that ADNR's decision with respect to the final best interest finding, and its denial of HEC's request for reconsideration, lacked a reasonable basis, and failed to show that ADNR gave the requisite "hard look" at all the salient facts and issues raised. HEC asked the court to remand the case to ADNR.

On March 18, 2008, ADNR submitted an unopposed motion to remand HEC's appeal, saying that it had reviewed HEC's opening brief, and based on that review, requested that the court remand this case to ADNR so that the commissioner may reexamine the facts and conclusions in both the final finding and his decision on reconsideration. On March 19, 2008, the court remanded the case to ADNR.

vi. Reconsideration

This document provides the commissioner's reexamination of the facts and conclusions of the October 2, 2006 final finding and points raised by HEC in its request for reconsideration, and the

commissioner's decision on remand that an exploration license for gas only for the Holitna Basin is in the best interests of the state.

C. Governmental Powers to Regulate Gas Exploration, Development, Production, and Transportation

All gas activities (exploration, development, production, and transportation) are subject to numerous federal, state, and local laws, regulations, policies, and ordinances, with which the licensee is obligated to comply. This section 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 spectrum of authority various government agencies have to prohibit, regulate, and condition activities related to gas. Important laws and regulations applicable to gas activities are included in Appendix B. Each regulatory agency (state, federal, and local) has a different role in the oversight and regulation of gas activities, although some agencies may have overlapping authorities.

A gas exploration license only gives the licensee, subject to the provisions of the license, the nonexclusive 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. The license itself does not authorize any exploration, development, or production activities.

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

1. Alaska Department of Natural Resources

ADNR, through the Division of Oil and Gas, Division of Mining, Land and Water, the Office of Project Management and Permitting, and the State Historic Preservation Office reviews, coordinates, conditions, and approves plans of operation or development and other permits as required before on-site activities can take place. The department monitors activities through field inspection once they have begun. Each plan of operation is site-specific and must be tailored to the activity requiring the permit. A plan of operation 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. Applications for other local, state or federal agency authorizations or permits must be submitted with the plan of operation.

a. Plan of Operation Approval

Before beginning any activities within the license area, licensees must prepare plans of operation and development that must be approved by DO&G. Except for uses and activities appearing on the list in 11 AAC 96.020, the licensee must prepare a plan of operation and obtain all required approvals and permits for each phase of exploration, development, or production before implementation of that activity. All permit applications and plans are available for public review and public notice is given for all development plans of operation.

An application for approval of a plan of operation 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 license 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 license 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 operation, 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 operation approval and are binding on the licensee. The license also requires that the licensee keep the license area open for inspection by authorized state officials. Activities are field-monitored by ADNR, ADEC, ADF&G, and AOGCC to ensure compliance with each agency's respective permit terms. In addition, each permittee must post a $500,000 statewide bond to cover a drill site. License operation approvals are generally granted for three years.

b. 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 permittee. 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).)

c. 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.

d. Temporary Water Use Authorization

Exploration activities may require a temporary water use authorization issued by DMLW. A temporary water use authorization is required before the temporary use of a significant amount of water under 11 AAC 93.035, 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.

e. 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 are subject to conditions such as requirements: that no certificate will 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 to 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, 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; the fee required must accompany the statement of beneficial use; and (2) has substantially complied with all permit conditions. Again, the commissioner will, in his or her discretion, issue a certificate subject to conditions necessary to protect the public interest. For example, conditions 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 achieve any of the following purposes: protection of fish and wildlife habitat, protection of recreation, protection of navigation, protection of sanitation and water quality, protection of prior appropriators, or any other purpose the commissioner determines is in the public interest (11 AAC 93.130(c)(1)).

f. 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 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.

g. 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 must include, if applicable, but is not limited to: 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.

h. 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. To date, 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) 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.

2. 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.

a. 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 six 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).

i. Title I (NSR) Construction Permits

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).

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.

ii. Title V Operation Permits

The federal Clean Air Act of 1970, and its subsequent 1990 revision and expansions (42 U.S.C. §§ 7401-7642), 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).

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.

b. 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 archeological features) with a cover letter describing 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 approved municipal solid waste landfill (MSWLF). MSWLFs are regulated under 18 AAC 60.300-.397. 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, prevent contamination of groundwater, and be of sufficient volume and integrity to prevent leakage due to erosion, precipitation, wind and wave action, and changing permafrost conditions. 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 is maintained by requirement. 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.

c. 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.

d. NPDES Certification

ADEC participates in the federal National Pollution Discharge Elimination System (NPDES) program that is administered by EPA (see EPA Section C6c 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's process for reviewing and issuing NPDES permits, and ADEC's process for certifying the permits include requirements for public notices, receiving, considering, and addressing public input (40 C.F.R. 125.32; 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 (ADEC 2008b; SOA 2008).

e. 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 U.S. Army Corps of Engineers Section C7 below) 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.

f. Oil Discharge Prevention and Contingency Plan

Licensees must comply with the requirements of AS 46.04.010 - .900, Oil and Hazardous Substance Pollution Control. This requirement includes the preparation and approval by ADEC of an Oil Discharge Prevention and Contingency Plan (C-Plan) (AS 46.04.030; 18 AAC 75.445).

Before receiving a permit to drill, the lessee must demonstrate in each plan of operation the ability to promptly detect, contain, and clean up any hydrocarbon spill before the spill affects fish and wildlife populations or their habitats. ADEC has authority under AS 46.04 for the purpose of preventing and cleaning up oil spills.

If transportation by water is planned, AS 46.04.030 requires that the lessee obtain the approval of ADEC for detailed oil spill contingency plans before the commencement of each aspect of the operation, including individual wells, drilling pads or platforms, pipelines, storage facilities, loading facilities, and individual tankers or barges.

3. 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.

a. Waters Important to Anadromous Fish and Fish Passage

Effective July 1, 2008, permitting authority for activities that may affect anadromous fish streams was transferred from ADNR, Office of Habitat Management and Permitting (OHMP) to ADF&G, Division of Habitat, which now administers the permitting process. Under this program, a Fish Habitat Permit is required before using, diverting, obstructing, polluting, or changing the natural flow or bed of an anadromous water 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.

4. 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).

a. Permit to Drill

i. 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 is not in the business of managing or deciding whether to develop state owned resources. Rather, it regulates certain oil and gas operations anywhere in Alaska, whether on state owned, federally owned, or privately owned 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.

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).

ii. 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 go-ahead. 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).

b. 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 must be into a well with equipment designed to ensure injected fluids are confined to the intended injection zone.

Along with a plat showing the location of other wells within one-quarter mile that penetrate the same disposal zone, 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 injected through a dedicated tubing string into the approved subsurface zone. The pumping of drilling wastes through the annular space of a well is an operation incidental to drilling of the well, and is not a disposal operation subject to regulation as a Class II well. AOGCC approval of annular disposal operations is required before commencing pumping operations (20 AAC 25.080).

c. Annular Injection

An AOGCC permit is required if fluid is to be injected into a well annulus. 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.

d. 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 (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.

5. State and Local Fire and Building Safety Offices

The Division of Fire and Life Safety, within the Alaska Department of Public Safety, is the State Building Official (ADPS 2008). Before construction, repair, remodel, addition, or change of occupancy of any building/structure, or installation or change of fuel tanks can occur, approval must be obtained from the Division of Fire and Life Safety. This division has responsibility for enforcing fire codes and reviewing plans for most of the state, except for specific cities which have been authorized to handle these responsibilities. The Division of Fire and Life Safety must examine and approve plans and specifications regarding the location of the building or structure on the property, area, height, number of stories, occupancy, type of construction, interior finish, exit facilities, electrical systems, mechanical systems, fuel storage tanks and their appurtenances, automatic fire-extinguishing systems, and fire alarm systems. However, structural considerations and accessibility are not reviewed, and review of mechanical and electrical systems only covers compliance with fire and life safety requirements (ADPS 2008).

6. 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.

a. 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 the ADEC section above for further details.

b. 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.

c. NPDES Permit

i. Permit Description

Effluents discharged by the oil and gas industry into waters and wetlands of the license area 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. 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).

ii. 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).

d. 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 C4 above); 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).

e. Spill Response Plan (C-Plan)

Owners or operators of non-transportation-related onshore and offshore 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 C.F.R. § 112. Drilling rigs are included in this facility definition. 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, cleanup, 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.

7. U.S. Army Corps of Engineers

a. Section 10 and Section 404 Permits

i. Permit Description

The U.S. Army Corps of Engineers (USACOE) 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 U.S.C. 401, et seq.; Section 10 [33 U.S.C. 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 USACOE, 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).

ii. 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 USACOE 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 USACOE considers in the permitting process (USACOE 2008a, b).

After receiving a formal application, the first step in the USACOE's 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, NMFS, ADNR, and ADF&G may also submit comments to the USACOE (USACOE 2008a, b).

Next, the USACOE 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 USACOE 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.

8. Pipeline and Hazardous Materials Safety Administration

The federal 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 all modes of transportation, including pipelines, under its jurisdiction (PHMSA 2008). Within PHMSA, the Office of Pipeline Safety is responsible for ensuring safety in the design, construction, operation and maintenance, and spill response planning of natural gas and hazardous liquid transportation pipelines under its jurisdiction. The Office of Pipeline Safety also administers a national pipeline inspection and enforcement program, implementation of risk management by pipeline operators, and provides assistance to state pipeline safety programs to ensure oversight of intrastate pipeline systems (PHMSA 2008); however, Alaska is not a member of this national pipeline inspection and enforcement program.

9. Other Requirements

Licensees must comply with other requirements, including federal law concerning Native allotments, rehabilitation of the license area to the satisfaction of the state, local and all applicable state and federal statutes and regulations.

a. 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, lessees must contact the Bureau of Indian Affairs (BIA) and the Bureau of Land Management (BLM) and obtain approval to enter.

b. Rehabilitation Following Lease Expiration

Upon expiration or termination of the exploration license, paragraph 14 of the license requires the licensee to rehabilitate the license area to the satisfaction of the state. The licensee is granted one year from the date of expiration or termination to remove all equipment from the license area and deliver the license area in good condition.

c. Applicable Laws and Regulations

In addition to existing laws and regulations applicable to oil and gas activities, paragraph 19 of the exploration license requires that licensees be subject to all applicable state and federal statutes and regulations in effect on the effective date of the license. The Holitna Basin 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.

Chapter Two: Property Description, Geology, and Petroleum Potential

Table of Contents

Page

A. Property Description 2-1
B. Geology and Petroleum Potential 2-3

List of Tables

Page

Table 2.1. Geologic time. 2-3

List of Figures

Figure **Page**

Figure 2.1. Bethel Census Area. 2-1
Figure 2.2. General land status of the Holitna Basin. 2-2
Figure 2.3. Geology of the Holitna Basin. 2-4

Chapter Two: Property Description, Geology, and Petroleum Potential

A. Property Description

The license area lies near the confluence of the Holitna River and Basket Creek, approximately 10 miles southeast of Sleetmute. It is within the Bethel Census Area (Figure 2.1) and is not within an organized borough. The state of Alaska identifies any area of the state that is not within the boundaries of an organized borough as part of a single unorganized borough. As an unincorporated area, the Bethel Census Area is recognized as part of the unincorporated borough. The state owns both the surface and subsurface estates of the license area (Figure 2.2).

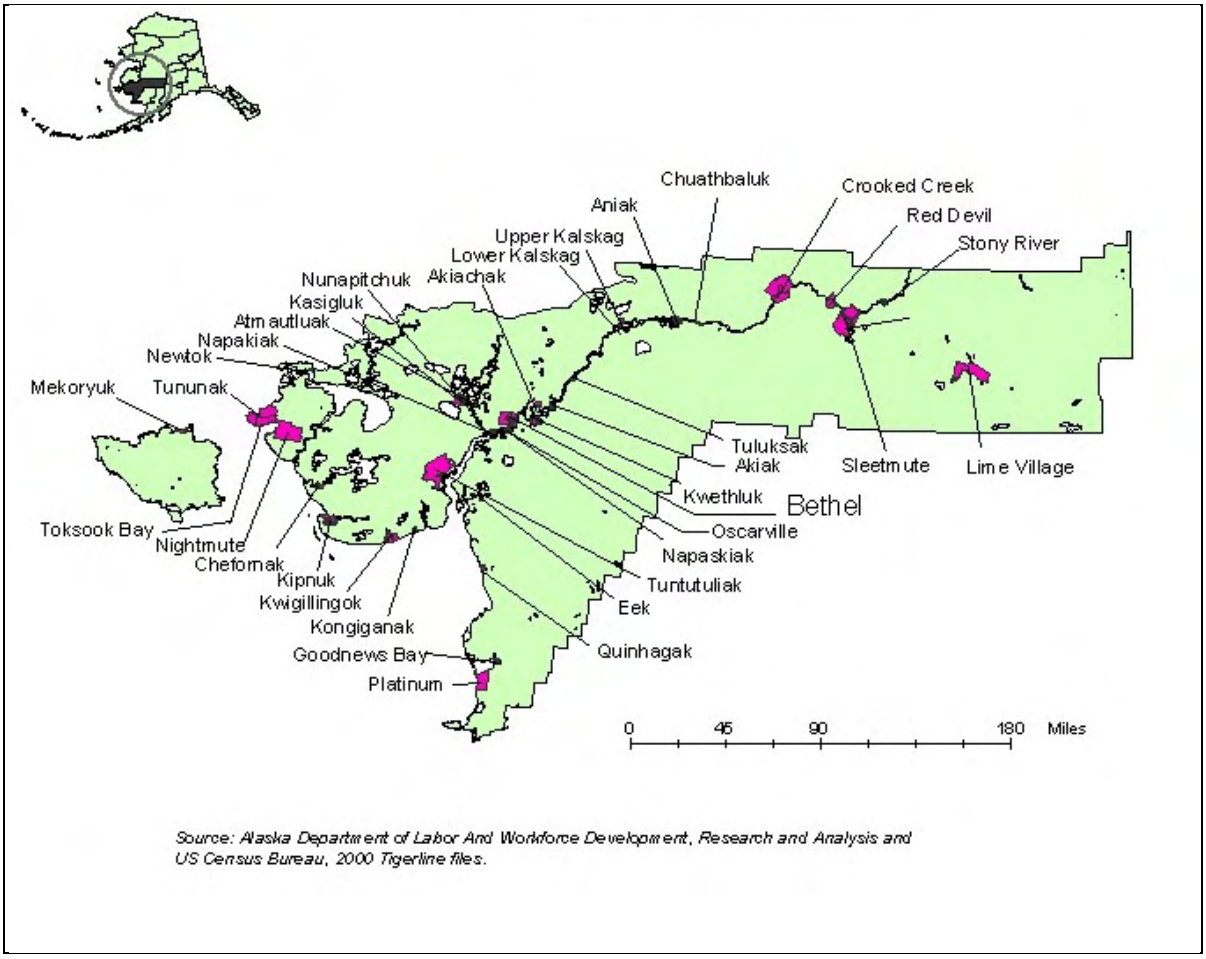
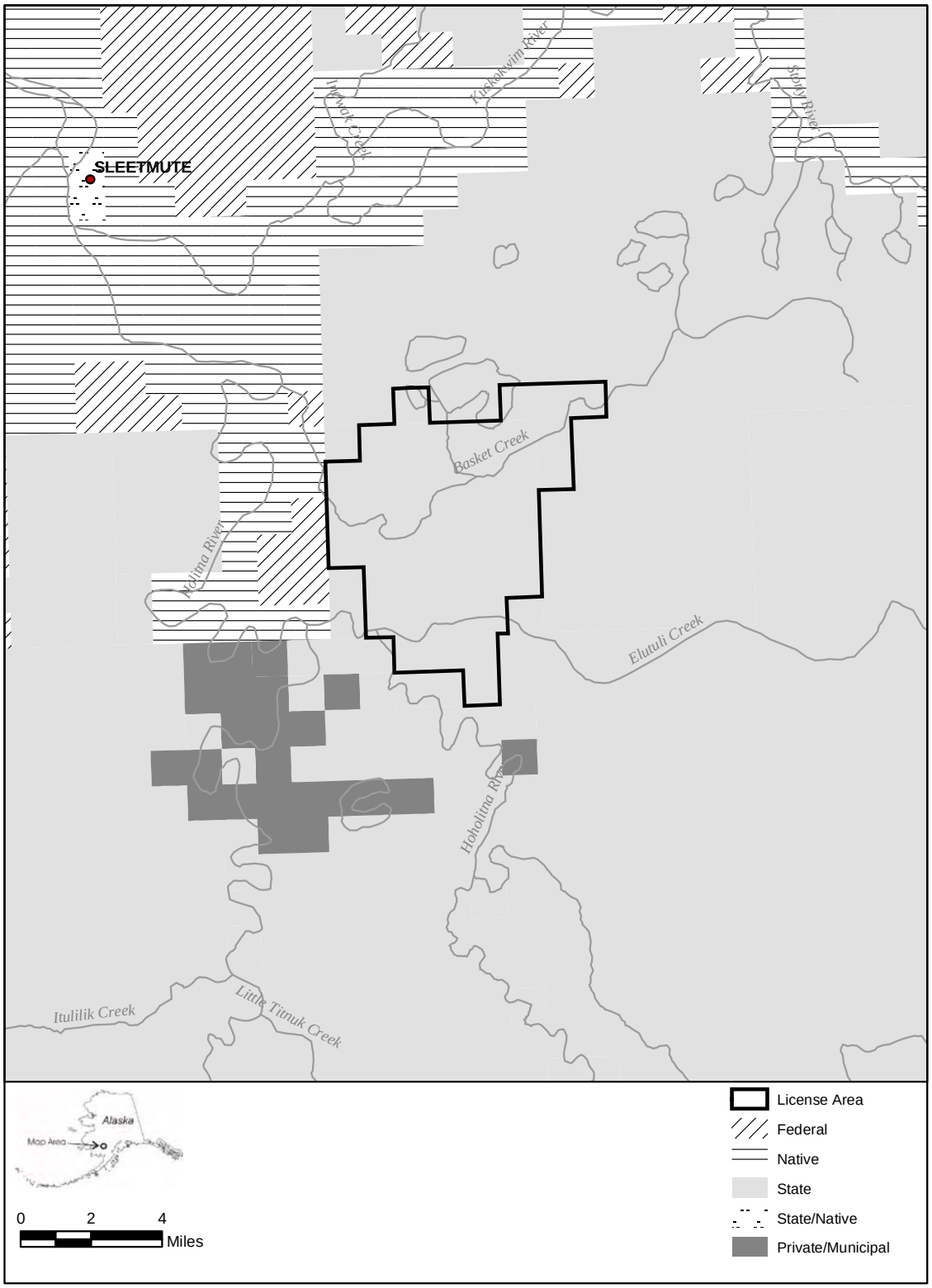


Figure 2.1. Bethel Census Area.



Source: BLM and ADNR 2004.

Figure 2.2. General land status of the Holitna Basin.

B. Geology and Petroleum Potential

The Holitna Basin is located along the Farewell Fault zone, one of the three fault complexes in the greater Denali Fault system. Formed during the late Paleozoic era, the Denali Fault system later was transformed to a strike-slip fault system as the directions of plate motion changed during the Tertiary period (Table 2.1; Figure 2.3). Some have interpreted the surface geology near the west end of the Farewell Fault zone as indicating as much as 100 kilometers (approximately 62 miles) of right-lateral displacement, but others have argued for left-lateral motion (LePain et al., 2003).

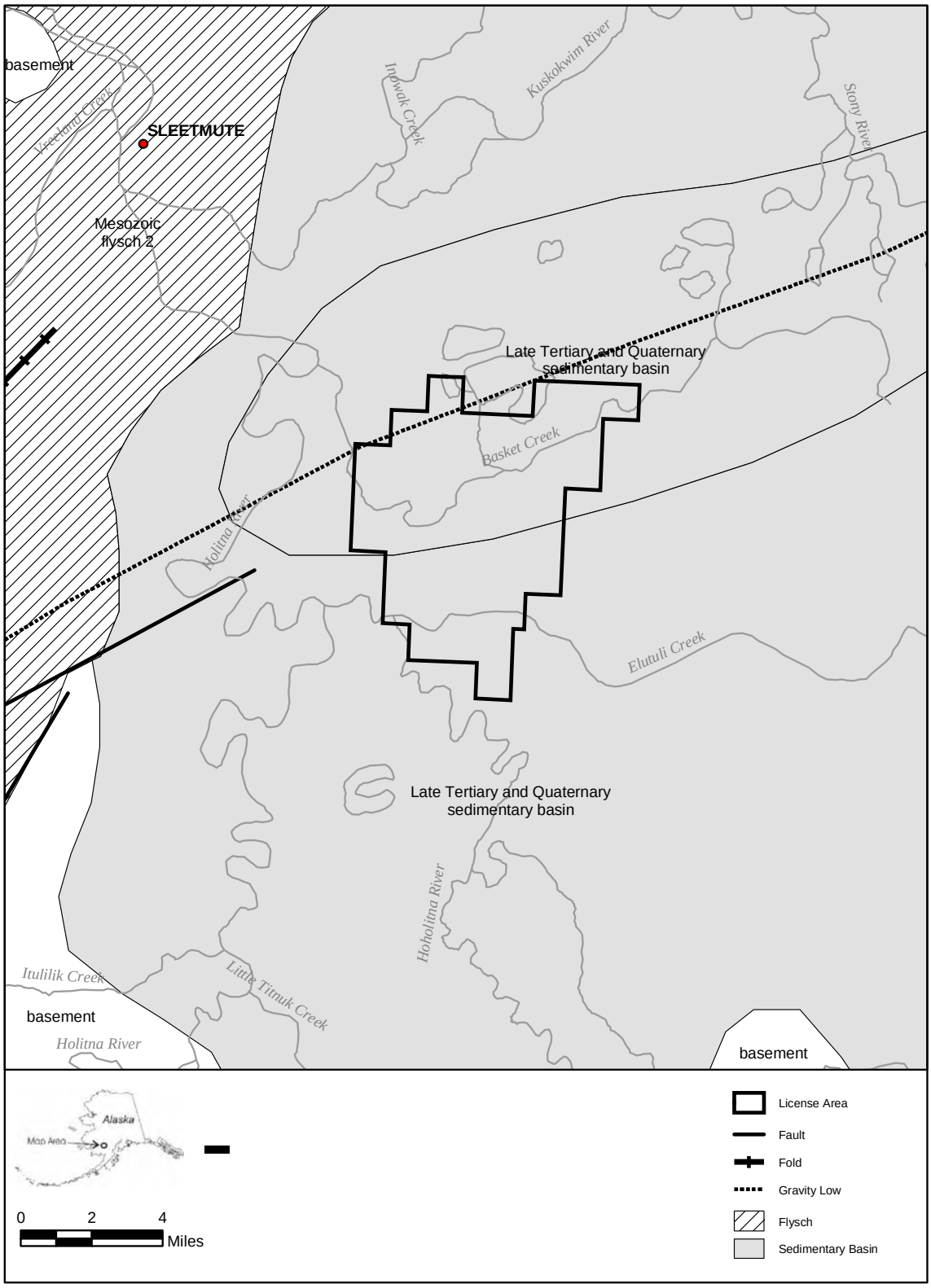
The basin is defined by gravimetric[1] data that indicate the basin is as deep as 4,600 meters (approximately 15,000 feet). In the absence of well and seismic subsurface data, the basin stratigraphy is poorly understood and largely extrapolated from surrounding surface outcrops and other Tertiary basins in central Alaska. Cretaceous strata of the Kuskokwim Group bound the basin to the north and west, and Paleozoic strata of the Nixon Fork and Dillinger sequences lie to the southwest, south, and east. Outcrop analogs to the northeast in the McGrath Quadrangle were used to estimate the character and age of the fill in the Holitna Basin. Strata on the Little Tonzona River are estimated to be early Oligocene in age with overlying strata becoming younger (mid-to-late Miocene) to the southwest in outcrops along the lower Cheeneetnuk River. Whether this age progression is indicative of a single depositional system or a series of cyclic episodes is unknown. If the Holitna Basin stratigraphy is related to the outcrops to the northeast, the basin fill may be middle Miocene or younger (LePain et al., 2003).

Table 2.1. 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).

[1] Of or relating to measurement of variations in a gravitational field; measurement of specific gravity obtained from a gravimeter.



Source: Troutman and Stanley 2002.

Figure 2.3. Geology of the Holitna Basin.

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 and geologic traps or reservoirs. Source rocks are sediments rich in organic materials, generally marine shales that have been buried for a sufficient time and with sufficient temperature and pressure to form hydrocarbons. As hydrocarbons are formed, they progress toward the surface if a migration route (permeable strata, fault fractures) is available. A hydrocarbon reservoir is porous and permeable rock that has been geologically sealed at an appropriate time to form a "trap" for the migrating hydrocarbons.

Two recent studies by the Division of Geological and Geophysical Surveys (DGGS) have evaluated petroleum potential in the Holitna Basin. The first study reviewed previous investigations by oil companies in the mid-1980s and a reconnaissance-level study by DGGS and the DO&G in 1998. Results from this study indicated a poor potential for commercial quantities of oil in the Holitna Basin and poor to fair potential for commercial quantities of gas (LePain et al., 2000). The second study included a stratigraphic analysis of potential reservoir rocks in the southern McGrath Quadrangle that are considered analogous to the Holitna Basin sediments. In the analog, the absence of visible porosity in outcrop samples implies low reservoir potential. However, suitable porosity and permeability may have been preserved in potential reservoir rocks at depth, allowing entrapment of any hydrocarbons generated within the basin. The potential for generation of conventional gas and oil is considered low, as possible source rocks appear to be absent in surface exposures throughout the region.

In addition to exploring for and producing conventional gas, an exploration license would allow a licensee to explore for nonconventional gas resources, such as coalbed methane gas (CBM) (natural gas, CH_4). CBM is a by-product of the transformation of decayed plant material into coal. There are two types: biogenic methane, produced during microbial decay of the 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. During the formation of coal, large quantities of methane-rich gas are generated and stored on its internal surfaces. Because coal has such a large internal surface area, it can store large volumes of methane-rich 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 feet per ton.

Coal seams occur in Tertiary nonmarine sediments along slivers of the Farewell Fault zone and, although a very minor component of the Tertiary section, might offer potential for shallow biogenic coalbed methane (LePain et al., 2000). However, a coalbed methane play depends on gas generated and stored in thick, extensive coalbeds, on favorable coal rank, and on appropriate basin hydrogeology. Surface exposures of coals observed in the Holitna Basin area do not appear to meet the coal criteria. Shallow gas may be present, however, if it has migrated from deeper source rocks or if it has formed by biogenic processes. The estimated gas potential in the Holitna Basin is 100 to 200 billion cubic feet (LePain et al., 2003) which, although not commercial, could be used for local consumption. Geophysical data from the Holitna Basin have been analyzed under contract to DGGS and are under review (Clough, 2004).

In addition to methane, coal seams contain water, which is under pressure and keeps the gas trapped in the coal. CBM wells require pumps to remove the water from the drilled wells in order to reduce the pressure in the coal seam. As the pressure is reduced in the coal seam, the gas is released from the coal. The methane molecules flow through the matrix of the coal until they reach the natural fractures or "cleats" found in the coal. Gas accumulates in the cleats and flows to the well with the water.

Alaska's hypothetical coal resources exceed 5.5 trillion short tons, nearly one-half of the U.S. total, and may contain more than 1,000 trillion cubic feet of methane gas. If only 10 percent of this

hypothetical resource is recoverable, it would triple the current proven conventional gas reserves for Alaska. Economically producible CBM 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 (Smith, 1995).

Chapter Three: Habitat, Fish, and Wildlife of the Holitna Basin

Table of Contents

Page

A. Habitat....3-1
1. Vegetation....3-3
2. Wetlands and Aquatic Plants....3-7
B. Fish and Wildlife Populations....3-10
1. Fish....3-10
2. Birds....3-13
a. Waterfowl....3-13
b. Cranes....3-16
c. Raptors....3-16
3. Terrestrial Mammals....3-17
a. Caribou....3-17
b. Moose....3-17
c. Brown Bears....3-19
d. Black Bears....3-19
e. Wolves....3-19
f. Furbearers....3-19
4. Threatened and Endangered Species....3-20

List of Tables

Table		Page
Table 3.1.	Vegetation classes in the Holitna Basin license area.	3-4
Table 3.2.	Plant species within or adjacent to the Holitna Basin license area.	3-9
Table 3.3.	Wetland vegetation classes in the Holitna Basin license area.	3-9
Table 3.4.	Anadromous and resident fish of the Holitna Basin.	3-10
Table 3.5.	Anadromous and resident fish streams within or adjacent to the Holitna Basin license area.	3-11
Table 3.6.	Historical salmon escapement for the Kogrukluk River weir, 1994-2004.	3-13
Table 3.7.	Bird observations within or adjacent to the Holitna license area, 1959-2004.	3-14
Table 3.8.	Bird observations in the Holitna Basin area.	3-14

List of Figures

Figure		Page
Figure 3.1.	Location of the Holitna exploration license area relative to Management Area 15: Holitna River, subunits 15A and 15C, of the Kuskokwim Area Plan.	3-2
Figure 3.2.	Vegetation types of the Holitna Basin.	3-8
Figure 3.3.	Anadromous fish streams of the Holitna Basin.	3-12
Figure 3.4.	Distribution of ducks and geese in the Holitna Basin area.	3-15
Figure 3.5.	ADF&G Game Management Units of the Holitna Basin area.	3-18

Chapter Three: Habitat, Fish, and Wildlife of the Holitna Basin

AS 38.05.035(g) directs that best interest findings consider and discuss the fish and wildlife species and their habitats in the license area. The Holitna Basin area includes a variety of habitats and a diversity of fish and wildlife species that support recreational and subsistence activities for residents and visitors to the area. Most habitats and populations of fish and wildlife in the area are healthy because of careful management and relatively recent population growth (ADF&G 2008a).

A. Habitat

The ADNR Kuskokwim Area Plan (KAP) (ADNR and ADF&G, 1987) describes how state land in the Kuskokwim River basin and a portion of the Innoko River basin will be managed. The plan balances competing interests in state lands in the Kuskokwim area and contributes to ADNR's statewide goals in a manner appropriate to the resources, economy, and communities of the area. The plan determines land offering locations, remote cabin areas, land classifications, land selections and relinquishments, areas open to mineral entry, and guidelines for leases and permits on state lands. Among the plan's goals are economic development and making coal, oil and gas, and geothermal resources available to contribute to national and state energy and mineral supplies and independence. All state lands within the planning area are available for oil and gas exploration and leasing. The plan provides guidelines for oil and gas development, including exploration techniques that minimize clearing, removal of abandoned facilities, pipeline design, and worker education.

The exploration license area is within Management Area 15 of the Kuskokwim Area Plan (Figure 3.1). Portions of the license area along the Holitna and Hoholitna rivers are within Subunit 15a (the Holitna-Hoholitna Corridors) while areas away from the main stems of these rivers (including the areas around Basket Creek, Elutuli Creek, and Big Lake) are within Subunit 15c (Hoholitna Lowlands) (OHMP, 2004[1]).

The KAP specifies that the emphasis of management of state land in the management area is "protection of the fish and wildlife habitat, and support for continued subsistence, commercial, and sport use of these resources." Lands within Subunit 15a are to be "managed to protect the fish and wildlife habitat and populations, and to support continued use of these resources. … Other uses of this land are permitted when compatible with the primary intent of protecting the fish and wildlife resources." Subunit 15c lands are to be "managed for multiple use, with the emphasis on fish and wildlife habitat and harvest" (ADNR and ADF&G, 1987).

The KAP, includes ratings of the habitat values of lands within the planning area based on estimates of habitat quality for key species (ADNR and ADF&G, 1987):

A-1 Habitat Land. A discrete habitat needed to sustain a species within a region, these are highly sensitive fish and wildlife habitats and human use areas. ADF&G recommends wildlife be the primary use of these areas with possible limited seasonal entry for some uses.

A-2 Habitat Land. These are habitats with fish and wildlife and related human use values of regional or statewide significance. These areas include the most intensive or highest quality public use areas or the most productive fish and wildlife habitats.

[1] Effective July 1, 2008, permitting authority for activities that may affect anadromous fish streams was transferred from ADNR, Office of Habitat Management and Permitting (OHMP) to ADF&G, Division of Habitat, which now administers the permitting process.

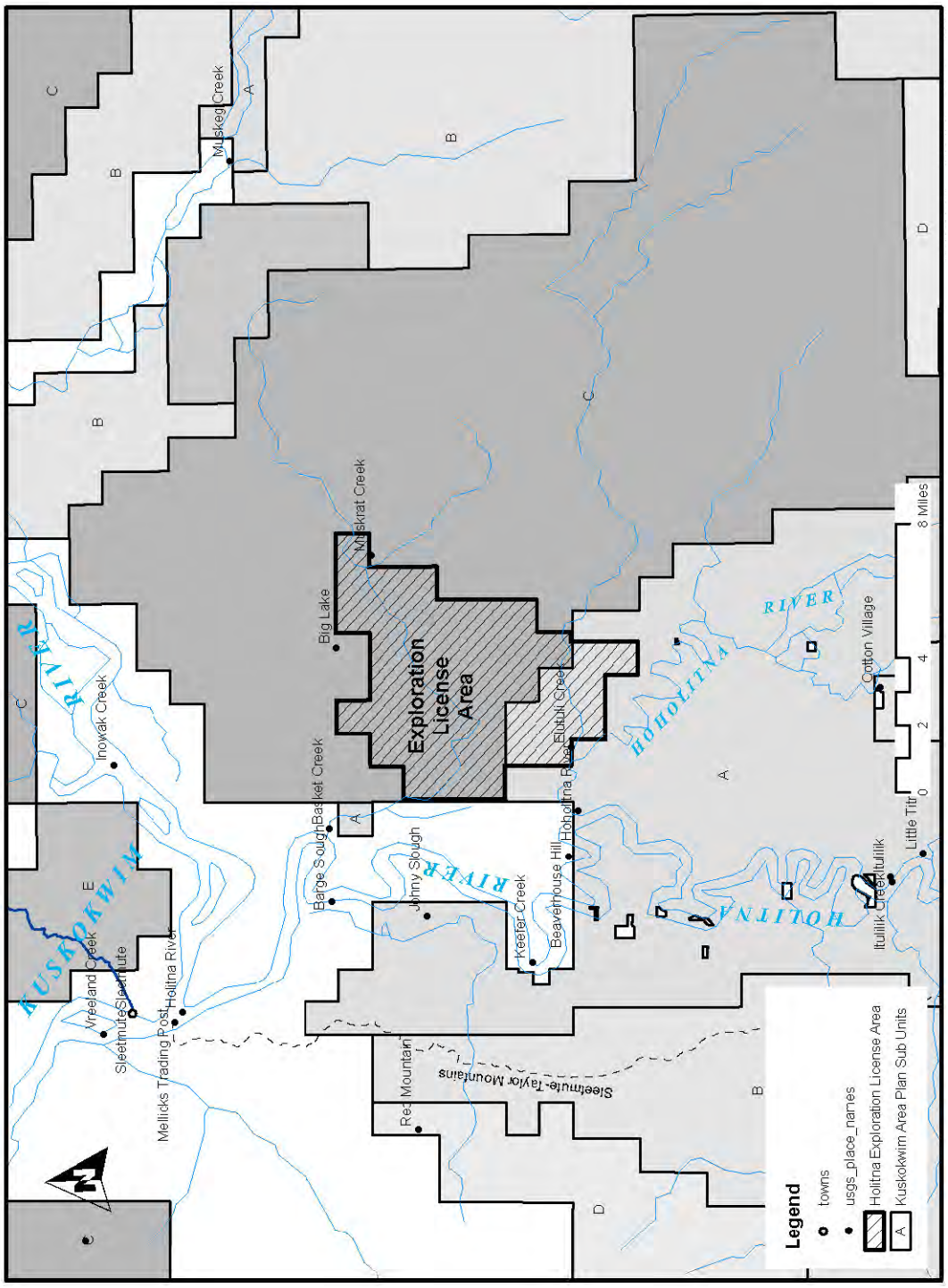


Figure 3.1. Location of the Holitna exploration license area relative to Management Area 15: Holitna River, subunits 15A and 15C, of the Kuskokwim Area Plan.

B-1 Habitat Land. These are habitats with fish and wildlife and related human use values that are less sensitive to disturbance. Compatibility of the habitat with other public resources is reasonably high.

B-2 Habitat Land. These are moderate value habitat or harvest areas. In this designation, ADF&G recommends that habitat be an alternative primary use with some secondary uses allowed if compatible.

C Habitat Land. ADF&G has determined that fish and wildlife habitat values are low and can be protected primarily through development of guidelines.

The area of the Holitna Basin in which the exploration license area is located was designated as an A-2 Habitat Land with fish and wildlife and related human use values of regional or statewide significance. Key resource species include salmon and resident fish, moose and caribou (winter range), brown bear (concentrations), and duck and goose (concentrations). Primary land use designations for subunits 15a are forestry and wildlife habitat; and for 15c are water resources and wildlife habitat. However, all state lands within the planning area are available for oil and gas exploration and leasing.

1. Vegetation

The license area includes 26,791 acres located between the Hoholitna, Holitna, and Kuskokwim rivers. The rivers contain large riparian corridors of white spruce (*Picea glauca*) and hardwood trees in buffers from one-half mile to two miles wide (ADNR and ADF&G, 1988). Several lakes and creeks located in the license area drain west into the Hoholitna and Holitna Rivers. A cooperative project between the Bureau of Land Management (BLM) and Ducks Unlimited, Inc., mapped vegetation types in the license area using remote sensing and GIS technology (BLM, 2002). Table 3.1 lists the habitat types and their distribution in the license area according to the classification scheme developed for the BLM study; the scheme was based on the Alaska Vegetation Classification (Viereck et al., 1992). The distribution of habitat types within the license area was calculated from the raster. The three dominant classes, which constitute more than half of the license area, are open needleleaf-lichen, woodland needleleaf, and moss. Open needleleaf-lichen vegetation classes are composed of 25 percent to 59 percent tree cover (of which 75 percent is either black or white spruce) with an understory of greater than 20 percent lichen. Woodland needleleaf vegetation classes are composed of 10 percent to 24 percent black or white spruce trees and a diverse understory. The moss class is composed of greater than 40 percent herbaceous species and greater than 60 percent cover of moss.

The original raster received from BLM was modified to create a map of the habitat types (Figure 3.2). The pixel resolution of the original raster was 30 meters by 30 meters, which made it difficult to discern the general habitat types in the license area. The raster was filtered to replace individual cell values where at least half of the contiguous eight cells had the same value. The filter was performed five times to produce a map that displayed the general distribution of the habitat types.

Table 3.1. Vegetation classes in the Holitna Basin license area.

Level II Vegetation Class	Level III/IV Vegetation Class	Area (acres)	Percentage of License Area
Aquatic Vegetation: This class was divided into aquatic bed and emergent vegetation classes.	**Aquatic Bed:** Aquatic vegetation makes up ≥20% of the cover, and ≥20% of the vegetation is composed of plants with floating leaves. This class is dominated by plants with leaves that float on the water surface, generally pond lilies (*Nuphar polysepalum*).	1.11	0.00%
	Emergent Vegetation: Aquatic vegetation makes up ≥20% of the cover, and ≥20% of the vegetation is composed of plants other than pond lilies. These include freshwater herbs such as horsetails (*Equisetum* spp.), marestail (*Hippuris* spp.), and buckbean (*Menyanthes trifoliata*).	153.25	0.57%
Barren: This class includes sparsely vegetated sites along with nonvegetated sites.	**Rock/Gravel:** About 50% of the area is barren, and about 50% of the cover is composed of rock and/or gravel, and vegetation makes up <20% of the cover. This class most commonly comprises barren mountaintops or glaciers but also includes abandoned gravel pits, riparian gravel bars, glacial till, and other sparsely vegetated or nonvegetated sites.	32.61	0.12%

-continued-

Table 3.1. Page 2 of 3.

Level II Vegetation Class	Level III/IV Vegetation Class	Area (acres)	Percentage of License Area
Forest: This class includes needleleaf and deciduous trees. The needleleaf species generally found were white spruce (*Picea glauca*) and black spruce (*P. mariana*). White spruce tend to occur on warmer sites that have better drainage, whereas black spruce dominate poorly drained sites and are more common than white spruce in Interior Alaska. Common deciduous tree species include paper birch (*Betula papyrifera*), aspen (*Populus tremuloides*), and cottonwood (*P. balsamifera* and *P. trichocarpa*). Black cottonwoods (*P. trichocarpa*) are generally found only in river valleys and on alluvial flats. Under some conditions, willow (*Salix* spp.) and alder (*Alnus* spp.) formed a significant part of the tree canopy. Deciduous stands are found in major river valleys, on alluvial flats, surrounding lakes, or, most commonly, on the steep slopes of small hills. Mixed deciduous/coniferous stands are present in the same areas as pure deciduous stands. While needleleaf stands are extremely extensive, deciduous and mixed deciduous/ coniferous stands are generally limited in size. The only exception to this rule is near major rivers, where relatively extensive stands consisting purely of deciduous trees occur on floodplains and in ancient oxbows.	**Closed Deciduous:** Trees compose ≥60% of the cover, and ≥75% of the trees are deciduous. This type occurs in stands of limited size, generally on the floodplains of major rivers but occasionally on hillsides, riparian gravel bars, or bordering small lakes. This class includes paper birch, aspen, or cottonwood.	1,119.33	4.18%
	Closed Mixed Needleleaf-Deciduous: Trees compose ≥60% of the cover, but neither needleleaf nor deciduous trees are ≥75% of the tree cover. This class is uncommon and found mainly along the meanders of major rivers.	73.11	0.27%
	Open Deciduous: From 25% to 59% of the cover is trees; ≥75% of the trees are deciduous and <25% are needleleaf. This is a relatively uncommon class.	82.62	0.31%
	Open Mixed Needleleaf-Deciduous: From 25% to 59% of the cover is trees, but neither needleleaf nor deciduous trees are ≥75% of the tree cover. This class occurs in regenerating burns, on hill slopes, or bordering lakes.	706.49	2.64%
	Open Needleleaf: From 25% to 59% of the cover is trees, and ≥75% of the trees are needleleaf. This class is very common throughout Interior Alaska. A wide variety of understory plant groups are present, including low and tall shrubs, forbs, grasses, sedges, horsetails, mosses, and lichens.	2,038.90	7.61%
	Open Needleleaf-Lichen: From 25% to 59% of the cover is trees (of which ≥75% are needleleaf); ≥20% of the understory is lichen.	7,247.41	27.06%
	Woodland Needleleaf-Moss: From 10% to 24% of the cover is trees (of which ≥75% are needleleaf); ≥20% of the understory is moss.	283.41	1.06%
	Woodland Needleleaf: From 10% to 24% of the cover is trees (of which ≥75% are needleleaf). Woodland understory is extremely varied and includes most of the shrub, herbaceous, or graminoid types present in the study area.	2,790.30	10.42%
	Woodland Needleleaf-Lichen: From 10% to 24% of the cover is trees (of which ≥75% are needleleaf); ≥20% of the understory is lichen. The lichen often occurs in small round patches between trees. Within the study area, this class is generally found along ridgetops or on riparian benches.	1,072.25	4.00%

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Table 3.1. Page 3 of 3.

Level II Vegetation Class	Level III/IV Vegetation Class	Area (acres)	Percentage of License Area
Herbaceous: The classes in this category include bryoids, forbs, and graminoids. Bryoids and forbs are present as a component of most of the other classes but rarely appear in pure stands. Graminoids such as *Carex* spp., *Eriophorum* spp., or bluejoint grass (*Calamagrostis canadensis*) may dominate a community.	**Lichen:** Composed of ≥40% herbaceous species, ≤25% water, and ≥60% lichen species.	23.42	0.09%
	Moss: Composed of ≥40% herbaceous species, ≤25% water, and ≥60% moss species.	5,720.30	21.36%
	Wet Graminoid: Composed of ≤25% water and ≥40% herbaceous species, where ≥60% of the herbaceous cover is graminoid and ≥20% of the graminoid cover is made up of *Carex aquatilis.* This class represents wet or seasonally flooded sites, often present in stands too small to be mapped at the current scale.	2,387.10	8.91%
Shrub: The tall and low shrub classes are dominated by willow species, dwarf birch (*Betula nana* and *B. glandulosa*), and *Vaccinium* species, with alder being somewhat less common. However, the proportions of willow to birch and the relative heights of the shrub species vary widely, which creates difficulties in determining whether a site is made up of tall or low shrub. As a result, the height of the shrub species making up the largest proportion of the site dictated whether the site is called a low or tall shrub. The shrub heights are averaged within a genus, as in the case of a site with both tall and low willow shrubs. Dwarf shrub commonly is composed of dwarf ericaceous shrubs and Dryas species, but often includes a variety of forbs and graminoids. The species composition of this class varies widely from site to site and includes rare plant species. It is nearly always found on hilltops or mountain plateaus, and may include some rock.	**Dwarf Shrub:** Shrubs ≤25 meters in height make up 40-100% of the cover. This class is generally made up of dwarf ericaceous shrubs and *Dryas* spp., but often includes a variety of forbs, graminoids, and some rock. It is nearly always found at higher elevations on hilltops, mountain slopes, and plateaus.	85.04	0.32%
	Dwarf Shrub Lichen: Shrubs <25 meters in height make up 40-100% of the cover, and >20% of the cover was made up of lichen. This class is generally made up of dwarf ericaceous shrubs and *Dryas* spp., but often includes a variety of forbs and graminoids. It is nearly always found at higher elevations on hilltops, mountain slopes, and plateaus. This class may be more open than the other dwarf shrub class.	78.22	0.29%
	Low Shrub: Shrubs 0.25-1.3 meters in height make up 40%-100% of the cover. This is the most common low shrub class and is generally composed of dwarf birch, willow species, *Vaccinium* species, and *Ledum* species.	788.75	2.95%
	Low Shrub Lichen: Shrubs 0.25-1.3 meters in height make up 40%-100% of the cover, and ≥20% of the cover was made up of lichen. This class is found at mid-high elevations. The shrub species in this class are nearly always dwarf birch.	7.17	0.03%
	Low Shrub-Wet	1,117.14	4.17%
	Tall Shrub: Shrubs ≥ 1.3 meters make up 40%-100% of the cover. This class generally has a major willow component mixed with dwarf birch and/or alder but could also have nearly pure stands of alder. It is found most often in wet drainages, at the heads of streams, or on slopes.	219.54	0.82%
Water: This class was divided into clear and turbid water classes.	**Clear Water:** Composed of ≥80% clear water.	713.03	2.66%
	Turbid Water: Composed of ≥80% turbid water.	38.41	0.14%
	Total	26,778.91	100.00%

Notes: Source of vegetation classes and raster data used for area calculations is BLM 2002.

Field sites were used to verify the classification of vegetation based on the aerial imagery. Vegetation recorded at field sites within or adjacent to the license area was used to develop the plant species list of Table 3.2. The vegetation is dominated by herbaceous species and prostrate and low shrubs. The dominant tall shrub and tree species include alder (*Alnus spp.*), black and white spruce (*Picea mariana* and *P. glauca*), aspen (*Populus tremuloides*) and willow (*Salix spp.*). National Wetland Indicator (NWI) status for each species is also included (see section "Wetlands and Aquatic Plants").

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)). Six Level III/IV vegetation classes identified in the Stony River MOA Earth Cover Classification (BLM, 2002) were used to approximate a minimum amount of wetland habitat in the license area: aquatic bed, emergent vegetation, wet graminoid, low shrub-wet, clear water, and turbid water (Fehringer, 2004). Other shrub classes may also include wetland areas, but the distinction between wetlands and upland shrub communities could not be made using remote sensing techniques. Table 3.3 includes a summary of the classes identified as wetland habitat inside the license area.

National Wetland Indicator (NWI) mapping is not available for the license area. USFWS has interpreted wetland areas from aerial mapping (Tande, 2004). The NWI status for plant species observed at field sites within or adjacent to the license area is included in Table 3.2.

USFWS has published a list of plant species for Alaska (USFWS, 1988) that assigns an indicator status based on the relative probability of each plant species' occurrence in wetlands. Definitions for each indicator status are:

OBL (obligate): Always found in wetlands under natural conditions (frequency, greater than 99 percent), but may persist in nonwetlands if planted or in wetlands that have been drained, filled, or otherwise transformed into nonwetlands.

FACW (facultative wetland): Usually found in wetlands (frequency, 34 to 66 percent), but occasionally found in nonwetlands.

FAC (facultative): Sometimes found in wetlands (frequency, 34 to 66 percent), but also occurs in nonwetlands.

FACU (facultative upland): Seldom found in wetlands (frequency, 1 to 33 percent), but commonly occurs in nonwetlands.

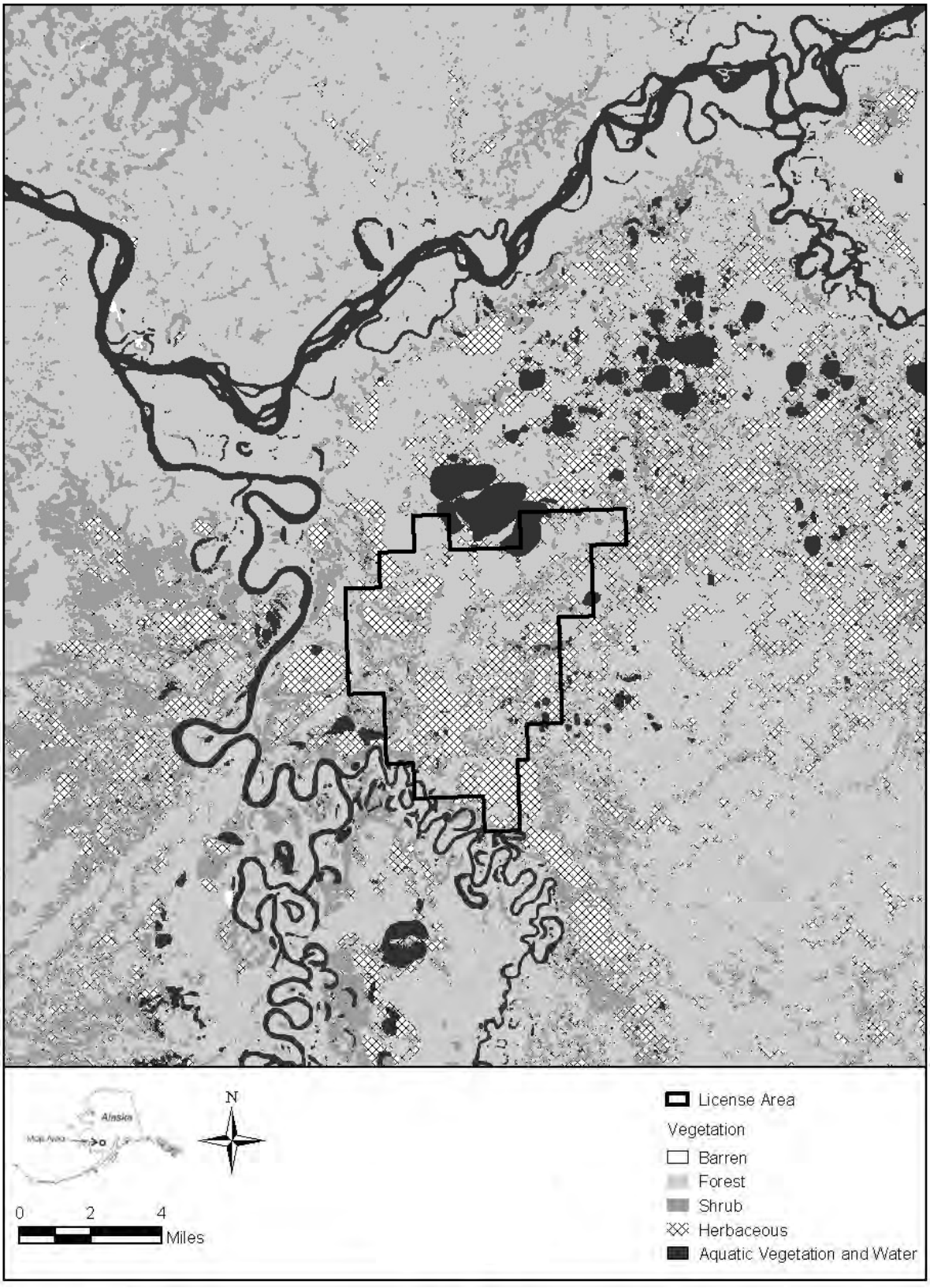
UPL (upland): Rarely found (frequency, less than 1 percent) in wetlands in Alaska. If a species does not occur in wetlands in any region (including outside Alaska), it is not on the list.

DRA (drawdown): Typically associated with the drier stages of wetlands, such as mud flats, vernal pools, and playa lakes.

NL: Not listed.

NI: Not yet assigned an indicator status.

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."



Source: BLM 2002.

Figure 3.2. Vegetation types of the Holitna Basin.

Table 3.2. Plant species within or adjacent to the Holitna Basin license area.

Scientific Name	Common Name	NWI Indicator Status
Aconitum delphinifolium	Mountain monkshood	FAC
Alnus crispa	Green alder	FAC
Alnus spp.	Alder	FAC
Andromeda polifolia	Dwarf bog rosemary	OBL
Betula glandulosa	Resin birch	FAC
Betula nana	Dwarf arctic birch	FAC
Betula papyrifera	Paper birch	FACU
Calamagrostis canadensis	Bluejoint reedgrass	FAC
Carex spp.	Sedge	OBL-FACU
Chamaedaphne calyculata	Leatherleaf	FACW
Cornus canadensis	Dogwood	FACU
Empetrum nigrum	Crowberry	FAC
Epilobium angustifolium	Fireweed	FACU
Equisetum spp.	Horsetail	OBL-FACU
Eriophorum spp.	Cottongrass	OBL-FACW
Ledum palustre	Labrador tea	FACW
Lycopodium spp.	Club moss	OBL-UPL
Menyanthes trifoliata	Buck-bean	OBL
Nuphar polysepalum	Showy yellow pond lily	OBL
Picea glauca	White spruce	FACU
Picea mariana	Black spruce	FACW
Potamogeton spp.	Pondweed	OBL
Populus tremuloides	Aspen	FACU
Rubus chamaemorus	Cloudberry	FACW
Salix spp.	Willow	OBL-UPL
Vaccinium microcarpus	Bog cranberry	OBL
Vaccinium uliginosum	Bog blueberry	FAC

Notes: NWI Indicator Status: See section "Wetlands and Aquatic Plants."

Source: BLM 2002.

Table 3.3. Wetland vegetation classes in the Holitna Basin license area.

Level II Vegetation Class	Level III/IV Vegetation Class	Area (acres)	% of License Area
Aquatic Vegetation	Aquatic Bed	1.11	0.00%
	Emergent	153.25	0.57%
Herbaceous	Wet Graminoid	2,387.10	8.91%
Shrub	Low Shrub-Wet	1,117.14	4.17%
Water	Clear Water	713.03	2.66%
	Turbid Water	38.41	0.14%
Total		4,410	16.47%

Notes: Source of vegetation classes and raster data used for area calculations: BLM 2002.

B. Fish and Wildlife Populations

1. Fish

Several streams and one major river in the license area support fish populations. The Hoholitna River crosses the southwest corner of the license area less than a mile upstream from its confluence with the Holitna River. Elutuli Creek, a tributary of the Hoholitna River, and Basket Creek, a tributary of the Holitna River, flow across the 6-mile-wide license area. Basket Creek drains Big Lake in the northern part of the license area. Several other small creeks and lakes can be found in the license area. The Hoholitna River is designated an anadromous water body (ADF&G, 2002). Both Basket Creek and Elutuli Creek support populations of anadromous whitefish (Burr, 2004; Mellick, 2004). A list of fish species that occur in the Holitna Basin is provided in Table 3.4.

The Hoholitna River supports five species of Pacific salmon, sheefish, several species of whitefish, northern pike, and Arctic grayling. Basket Creek and Big Lake are important passage, rearing, and spawning areas for whitefish and northern pike (Mellick, 2004; Burr, 2004). Basket Creek is also an important migratory route for Arctic grayling. Elutuli Creek supports northern pike and whitefish (McLean, 2003). Table 3.5 lists the known resident and anadromous fish populations in or adjacent to identified water bodies in the license area, and Figure 3.3 shows the streams where anadromous fishes are found.

Table 3.4. Anadromous and resident fish of the Holitna Basin.

Scientific Name	Common Name	Anadromous
Salmon		
Oncorhynchus gorbuscha	Pink salmon	Yes
Oncorhynchus nerka	Sockeye salmon	Yes
Oncorhynchus tshawytscha	Chinook salmon	Yes
Oncorhynchus kisutch	Coho salmon	Yes
Oncorhynchus keta	Chum salmon	Yes
Char		
Salvelinus namaycush	Lake trout	No
Salvelinus alpinus	Arctic char	No
Salvelinus malma	Dolly Varden	No
Other Species		
Thymallus arcticus	Arctic grayling	No
Esox lucius	Northern pike	No
Stenodus leucichthys	Sheefish	Yes
Lota lota	Burbot	No
Coregonus nasus	Broad whitefish	Yes
Coregonus oidschian	Humpback whitefish	Yes
Prosopium cylindraceum	Round whitefish	No

Source: Burr 1999 and McLean 2003.

Table 3.5. Anadromous and resident fish streams within or adjacent to the Holitna Basin license area.

Catalog Number	Stream Name	Fish Species
335-20-16600-2830	Holitna River	CHsr, COsr, Ksr, Psr, Ssr, SFsr, WFsr, AGsr, NPsr
335-20-16600-2830-3041	Hoholitna River	CHsr, COsr, Ksr, Psr, Ssr, SFsr, WFsr, AGsr, NPsr
Not designated	Basket Creek	AGp, NPp, WFr
Not designated	Big Lake	AGp, NPs, WFs
Not designated	Elutuli Creek	AGp, NPp, WFp

Notes: AG = Arctic grayling, CO = coho salmon, CH = chum salmon, K = Chinook salmon, NP = northern pike, P = pink salmon, S = sockeye salmon, WF = whitefish, SF = sheefish; p = present but not spawning or rearing, r = rearing, s = spawning.

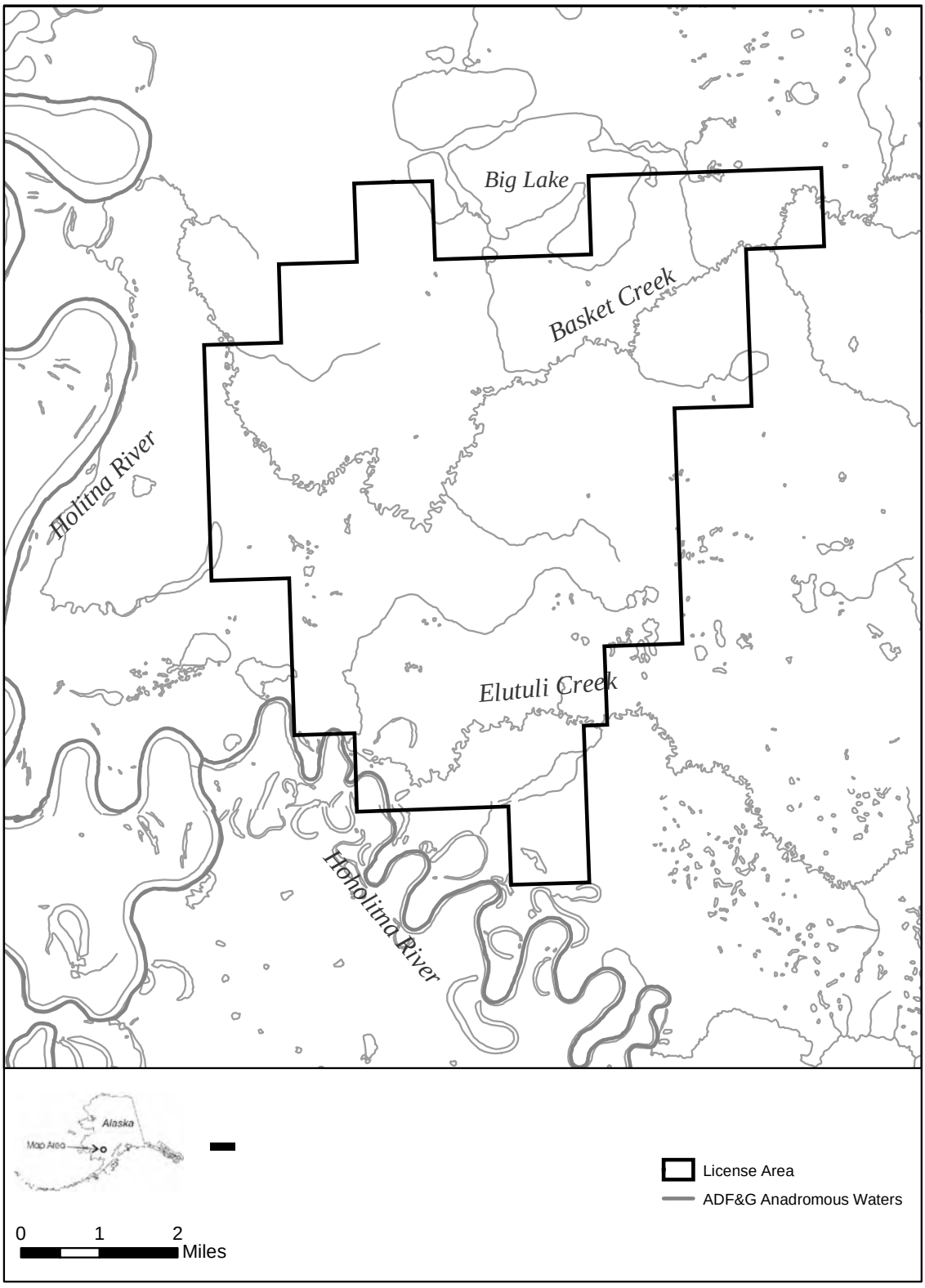
Source: McLean, 2003.

The anadromous fish species in the Holitna Basin include five species of Pacific salmon, sheefish, and broad and humpback whitefish. Anadromous fish migrate from marine waters to freshwater systems for spawning. Chum salmon have the largest returns of all five species of salmon in the Holitna Basin. Chum salmon spawn in both the Holitna and Hoholitna rivers from mid-July to mid-August. The peak of the run past the Kogrukluk River weir is usually in mid-to-late July (ADF&G, 1987). Table 3.6 lists the historical escapement counts for all five species of salmon at the Kogrukluk River weir. The weir is located 75 river miles upstream from the mouth of the Holitna River. Coho salmon migrate upstream in mid-to-late July and arrive in the Holitna River system in early August. Spawning normally occurs from mid-September to late October.

Chinook salmon are the first species to enter the Kuskokwim River and its tributaries. Twenty-five percent of Kuskokwim River Chinook salmon come from the Holitna River drainage basin. Chinook salmon move into the Holitna and Hoholitna drainages in late June and peak in early July (Burr, 1999). Fifty percent of sockeye salmon entering the Kuskokwim River are headed to the Holitna River; these sockeye may be unique because they spawn and rear in the river environment, whereas most sockeye populations depend on lake systems for early life history (KRSMWG, 2005). The peak sockeye salmon spawning in the Hoholitna River occurs during the second week of August. Pink salmon have the smallest populations of all salmon in the Kuskokwim River and its tributaries. Spawning occurs in tributaries through late July and returns are higher on even years (ADF&G, 1987).

Humpback and broad whitefish migrate upstream in the early summer for feeding and move farther upstream in the late summer and fall to spawn. Adults generally exhibit annual migrations to coastal areas to overwinter. Sheefish are a species of whitefish that overwinter in the Kuskokwim Delta and migrate upstream to feeding and spawning grounds after stream ice breaks up in the spring. Spawning occurs from late September into early October, after which sheefish migrate downstream once again to their feeding grounds. Sheefish are specific in their spawning requirements, selecting habitat with differentially sized gravels in 4 to 8 feet of fast-moving water (Alt, 1994).

Resident fish species include Arctic grayling, northern pike, round whitefish, and burbot. Several species of char may also be distributed in the waterbodies of the Holitna Basin. Arctic grayling overwinter in the Kuskokwim River and in lower reaches of its tributaries. Arctic grayling move upstream after breakup and distribute themselves throughout the tributary systems. Arctic grayling are found both in streams and lakes but are more abundant in streams (ADF&G, 1986b). Northern pike are distributed throughout the Holitna Basin and are found in slow-moving shallow water in the summer and move into faster moving sections of tributaries for overwintering (ADF&G, 1986b; McLean, 2003). Burbot are found in lakes and interconnecting streams and may migrate to spawning areas in the fall and winter. Burbot spawn under the ice in February and March (Holmes, 1994).



Source: ADF&G, 2002.

Figure 3.3. Anadromous fish streams of the Holitna Basin.

Table 3.6. Historical salmon escapement for the Kogrukluk River weir, 1994-2004.

Year	Operating Period	Chinook[c]	Sockeye	Chum[d]	Pink	Coho[e]
1994	07/02 to 09/14	15,227 [b]	14,192 [b]	46,635 [b]	23 [a]	34,695 [b]
1995	07/02 to 09/06	20,630	10,996	31,265	2 [a]	27,861
1996	06/29 to 09/15	14,199	15,385	48,495	6 [a]	50,555
1997	06/28 to 09/21	13,286	13,078	7,958	0 [a]	12,237
1998	07/18 to 09/19	12,107 [b]	16,773 [b]	36,442 [b]	1 [a]	24,348 [b]
1999	07/06 to 09/18	5,570	5,864	13,820	0 [a]	12,609 [c]
2000	07/02 to 09/20	3,310	2,867	11,491	2 [a]	33,135
2001	06/21 to 09/25	9,298 [b]	8,773 [b]	30,569 [b]	9 [a]	19,387 [b]
2002	06/26 to 09/24	10,104	4,050	51,570	15 [a]	14,516
2003	06/21 to 09/20	11,771	9,138	23,411	3 [a]	74,754
2004	06/21 to 09/18	19,503	6,671	24,182	14	26,993

[a] Field operations were incomplete and no total annual escapement was estimated.

[b] Field operations were incomplete; more than 20 percent of total annual escapement is based on daily passage estimates.

[c] Field operations were incomplete; 10 to 20 percent of total annual escapement is based on daily passage estimates.

[d] Escapement goal is 5,300 to 14,000.

[e] Escapement goal is: 15,000 to 49,000.

[f] Escapement goal is: 13,000 to 28,000.

Source: ADF&G 2004a.

2. Birds

a. Waterfowl

Large numbers of waterfowl utilize the extensive wetland habitat associated with the drainages of the Holitna, Hoholitna, and Stony rivers entering the Kuskokwim River. Western and Interior Alaska provide breeding, resting, and staging habitat for waterfowl migrating from the Pacific, Central, and Atlantic flyways. Waterfowl usually arrive before breakup in April or May and stay until after freeze-up in October (ADF&G, 1987).

Two USFWS waterfowl surveys include transects that cross the license area. The North American Waterfowl Breeding Pair Survey (NAWBPS) has been collecting data since 1957 along transects throughout the state in wetland areas. There are three segments within the Holitna Basin, one of which crosses the license area. This segment starts at the confluence of the Hoholitna and Holitna rivers and ends at the headwaters of Basket Creek. Data for the period 1959-2004 indicate the birds most commonly found in the license area (Conant and Groves, 2003; Groves, 2004). Scoters, pintails, white-fronted geese, scaups, and mallards were all observed more than 100 times along this transect over the last 40 years. The list of birds observed along this transect and their abundance is provided in Table 3.7.

An expanded waterfowl survey performed by Bob Platte of the USFWS on the Tanana/Kuskokwim Lowlands in 2001–2002 includes 14 transects from the Holitna River to the Stony River. A list of bird species observed during the NAWBPS from 1959–2004 and from the expanded waterfowl surveys in 2001–2002 is included in Table 3.8 (Platte, 2003).

Table 3.7. Bird observations within or adjacent to the Holitna license area, 1959-2004.

Common Name	Observations	Common Name	Observations
Unidentified scoter	555	Sandhill crane	17
Pintail	237	Common loon	14
Unidentified duck	151	Long-tailed duck	12
White-fronted goose	147	Pacific loon	12
Scaup	122	Red-throated loon	12
Mallard	116	Canvasback	10
Green-winged teal	70	Bufflehead	9
Wigeon	62	Black scoter	7
Shoveler	36	Unidentified grebe	6
Swan	32	Merganser	2
Surf scoter	29	Ring-necked duck	1
Goldeneye	24	Osprey	1
Canada goose	18		

Source: Conant and Groves 2003; Groves 2004.

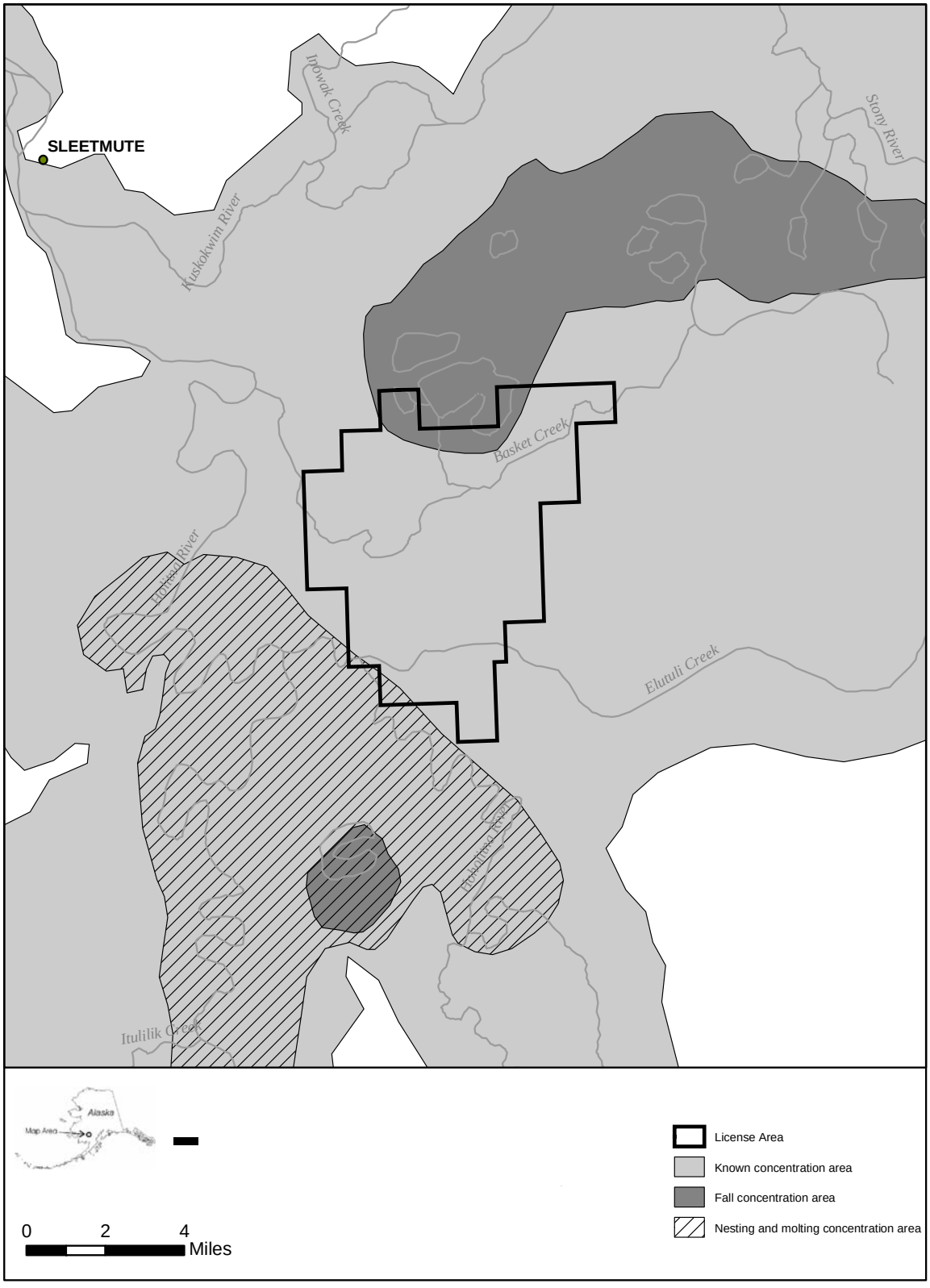
Table 3.8. Bird observations in the Holitna Basin area.

Common Name	Scientific Name	Common Name	Scientific Name
American wigeon	*Anas americana*	Northern pintail	*Anas acuta*
Arctic tern	*Sterna paradisaea*	Northern shoveler	*Anas clypeata*
Bald eagle	*Haliaeetus leucocephalus*	Osprey	*Pandion haliaetus*
Black scoter	*Melanitta nigra*	Pacific loon	*Gavia pacifica*
Bufflehead	*Bucephala albeola*	Red-throated loon	*Gavia stellata*
Canada goose	*Branta canadensis*	Redhead	*Aythya americana*
Canvasback	*Aythya valisineria*	Red-necked grebe	*Podiceps grisegena*
Common loon	*Gavia immer*	Ring-necked duck	*Aythya collaris*
Goldeneye	*Bucephala clangula*	Sandhill crane	*Grus canadensis*
Green-winged teal	*Anas crecca*	Scaup	*Aythya spp.*
Long-tailed duck	*Clangula hyemalis*	Surf scoter	*Melanitta perspicillata*
Mallard	*Anas platyrhynchos*	Trumpeter swan	*Cygnus buccinator*
Merganser	*Mergus merganser*	White-fronted goose	*Anser albifrons*
Mew gull	*Larus canus*	Wigeon	*Anas americana*

Source: Platte 2003; Conant and Groves 2003; Groves 2004.

Several species of **ducks** inhabit the Holitna Basin area. Big Lake is a fall concentration area and molting concentration area for ducks and geese. The Holitna River and Hoholitna River corridors are nesting and molting concentration areas. The entire license area provides suitable habitat within the known range of dabbling or diving ducks and/or geese (ADF&G, 1986a). The range and concentration areas for ducks and geese are provided in Figure 3.4.

The range of the **white-fronted goose** and **Canada goose** includes the license area. Other goose species that have habitat ranges in Alaska do not utilize the license area. White-fronted geese are among the first species of waterfowl to arrive in the spring. They depart early in the fall and are mostly gone by the third week of September (Rothe, 1994).



Source: ADF&G 1986a.

Figure 3.4. Distribution of ducks and geese in the Holitna Basin area.

The **lesser Canada goose** is the only Canada goose subspecies whose summer range includes the license area. Lesser Canada geese nest throughout river drainages in Western and Interior Alaska (Timm and Rothe, 1994).

Two species of **swans** are found in Alaska: trumpeter swans and tundra swans. Trumpeter swans nest throughout Interior and Western Alaska, while tundra swans nest primarily in coastal areas from Kotzebue Sound to Bristol Bay. Both species winter in coastal areas from Cordova south to Central California. The license area includes summer nesting habitat for trumpeter swans (Rosenberg and Rothe, 1994b). Jack Whitman, an ADF&G biologist with the Nongame Program, reported that there is normally at least one trumpeter swan nest on Big Lake and that the southeast section of the lake is used extensively as a brooding and feeding area for trumpeter swans. He also noted that trumpeters use the lake as a staging area in September and October (Whitman, 2004). Swans begin nesting soon after spring thaw in marsh areas adjacent to lakes. They migrate to their southern range in late September or October.

Trumpeter swan summer populations in Alaska have been surveyed every five years by USFWS since 1968. Data provided for the license area and surrounding quads for the 1995 and 2000 surveys report two pairs were observed on Big Lake in 1995 and one pair with six young were observed on Big Lake in 2000 (Conant et al., 2001).

b. Cranes

Sandhill cranes migrate to their nesting habitat in tundra, marshes, and muskegs in early- to mid-May. Their distribution includes the license area, as the habitat is suitable for feeding and nesting. Seventeen cranes have been observed as part of the NAWBPS in the license area since 1959 (Conant and Groves, 2003). Cranes return south to their winter ranges in mid-September (Rosenberg and Rothe, 1994a).

c. Raptors

A raptor survey performed on the Kuskokwim River between McGrath and Aniak in 1979-1980 observed the following species: rough-legged hawk, red-tailed hawk, marsh hawk, bald eagle, osprey, peregrine falcon, great horned owl, short-eared owl, hawk owl, boreal owl, raven, and goshawk (Mindell and Dotson, 1980).

Basket Creek, Elutuli Creek, and the riparian corridor along the Holitna and Hoholitna rivers are used as nesting habitat for bald eagles, ospreys and great gray owls (Boudreau, 2004; Whitman, 2004). Bald eagles return to the same nests each year, and Interior Alaska populations prefer old trees along rivers. Eagles mostly prey on salmon but may also eat waterfowl and small mammals. Eagles start building nests 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 (Daum, 2003). Bald eagles are protected by the Bald Eagle Protection Act, which prohibits the taking or possession of and commerce in bald and golden eagles (16 U.S.C. §§ 668-668d, June 8, 1940, as amended 1959, 1962, 1972, and 1978).

Ospreys 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 ospreys hatch around late June and do not leave the nest until mid-August. Ospreys migrate south for the winter in the fall, and most are gone by October (VanDaele, 1994).

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 (Osborne, 1994). Great gray owls utilize old hawk nest sites from March to June.

3. Terrestrial Mammals

Numerous species of terrestrial mammals inhabit the license area, including caribou, moose, wolf, black bear, brown bear, and furbearers. Game management units (GMUs) are shown on Figure 3.5. The license area is located in GMU 19A.

a. Caribou

The license area provides suitable habitat within the known range of caribou (*Rangifer tarandus*), including seasonal use and life function use areas (ADF&G, 1986a). The Mulchatna caribou herd was estimated at 147,000 animals in 2002. The herd had been increasing at a rate of 17 percent during 1981-1996, when it peaked at 200,000 (Woolington, 2003). During the period of population growth, its winter range expanded north into the Holitna Basin along the Holitna and Hoholitna rivers (Boudreau, 2001b). The ADF&G area biologist noted that the Mulchatna caribou herd has been observed migrating through the license area at least three times in the last eight years: 1996, 1998, and 2004 (Boudreau, 2004). No known calving concentration areas for caribou occur in the Holitna Basin. Caribou migrate through the license area when they move to their wintering range in the fall and return in the spring.

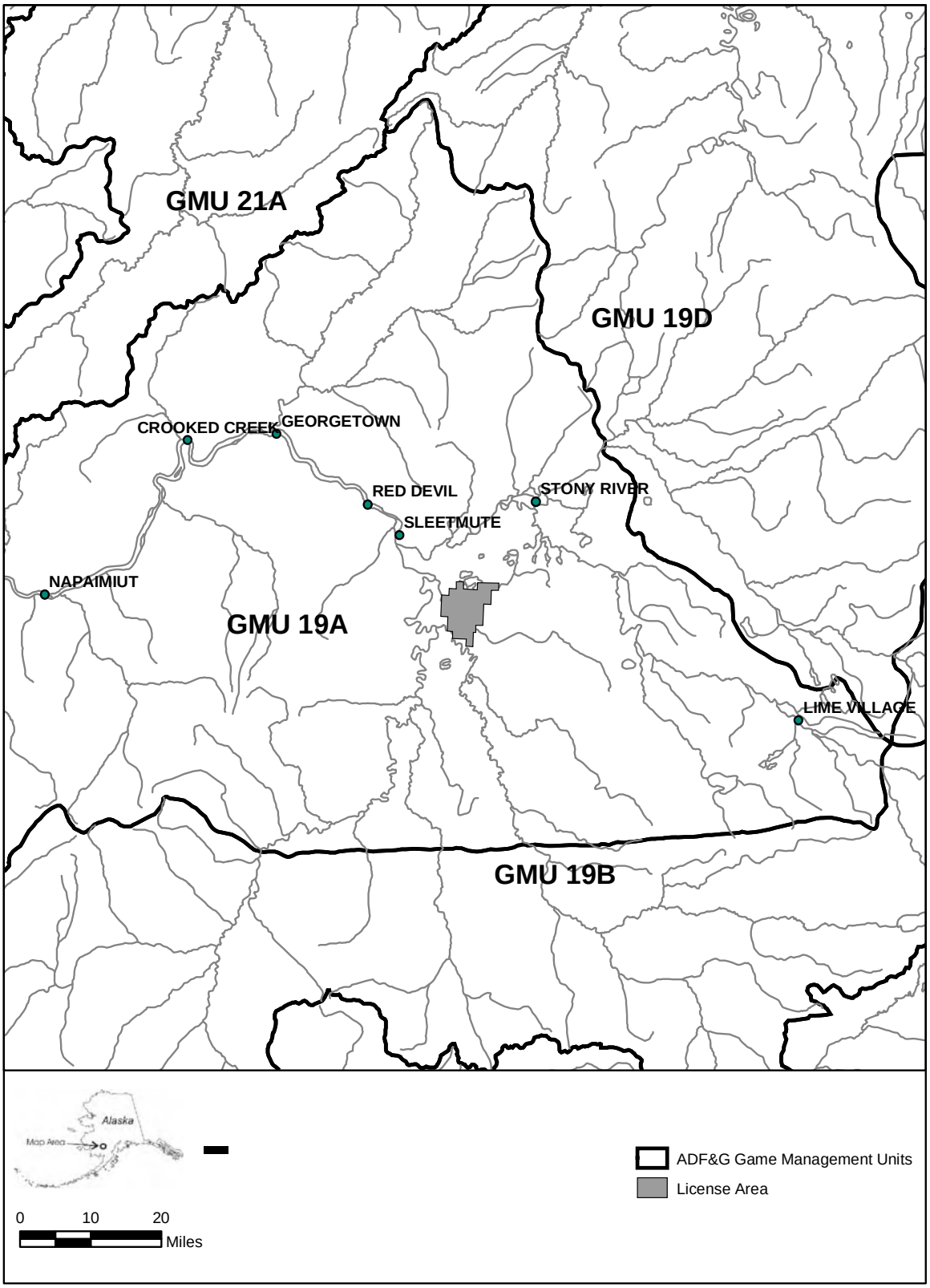
Winter habitat for caribou includes spruce forests, bogs, and lakeshores. Fruticose lichens (typically found in spruce-lichen associations), sedges, and grasses are the dominant food species. Although caribou use willows, horsetails, and dwarf shrubs to a lesser extent, they still are potentially significant sources of nutrition (ADF&G, 1986b).

b. Moose

The entire license area is a known moose (*Alces alces gigas*) winter concentration area. The corridors along the Holitna and Hoholitna Rivers are known moose calving and rutting concentration areas. Calving and rutting concentration areas inside the license area include the western and southern boundaries closest to the major rivers (ADF&G, 1986a). The ADF&G area biologist noted that moose primarily use the license area for calving, summer habitat, and movement between the Holitna and Stony Rivers; in winter, moose concentrate along the riparian corridors (Boudreau, 2004). Observations and available data on moose populations in GMUs 19A and 19B indicate that numbers have been declining in the Holitna Basin (Harms, 2003).

Concerns over a declining moose population important to both resident and nonresident hunters prompted the Alaska Board of Game to establish a wolf control program on July 1, 2004 (Alaska Board of Game, 2004). The ADF&G prepared a Central Kuskokwim Moose Management Plan in June 2004 to help restore and maintain the moose population in the area. Recent surveys were summarized in the plan to facilitate management decisions. A 2005 survey in the Holitna and Hoholitna drainages indicated a density of 0.27 moose per square mile. The population was estimated at 1,650-2,250 moose for GMU 19A (Boudreau, 2004). A survey on calf survival conducted in April 2003 reported a 7.6 percent calf survival rate in the Holitna and Hoholitna drainages; a minimum rate of 15 percent is necessary to increase moose populations (ADF&G, 2004b).

Moose calving occurs from mid-May to early June and rutting occurs late September to early October. Moose may migrate distances of only a few miles to more than 60 miles between calving, rutting, and winter habitats. 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.*), aspen (*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



Source: ADF&G.

Figure 3.5. ADF&G Game Management Units of the Holitna Basin area.

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 (herbaceous vegetation emerging from surface water) are the most important winter habitat for moose; as snow depth increases, moose move to closed canopy forests with available understory vegetation (ADF&G, 1986b; Rausch and Gasaway, 1994).

c. Brown Bears

The license area includes suitable habitat for brown bears (*Ursus arctos*) within their known range (ADF&G, 1986b). The estimated population in GMU 19A is 200 bears, based on habitat quality and densities reported in other parts of Interior Alaska (Boudreau, 2001a).

Brown bear densities are seasonally variable depending on available food sources; highest densities are found in the mountains, foothills, and mountain valleys, while low densities are found in the forested lowlands. Brown bears are opportunistic omnivores and heavily depend 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, as well as carrion from winter kills and moose and caribou calves. During the summer to fall, salmon are used extensively as a food source when and where available. In addition to the above mentioned plants, salmonberries (*Rubus spectabilis*), Devil's club (*Oplopanax horridus*), crowberries (*Empetrum nigrum*), blueberries (Vaccinium uliginosum), soapberries (Shepherdia canadensis), and lowbush cranberries (*Vaccinium vitis-idaea*) are readily eaten when available (ADF&G, 1986b).

d. Black Bears

Black bears (*Ursus americanus*) inhabit forested areas in Western Alaska; they are not as common along salmon streams or close to villages due to competition and predation from brown bears (Woolington, 2002). Although suitable black bear habitat exists within the study area, no population data is available.

Black bear distribution is variable, shifting seasonally. After emerging from dens, 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).

e. Wolves

The estimated population of wolves (*Canis lupus*) in GMU 19A is 180–240 animals separated into 24–28 packs (Alaska Board of Game, 2004). 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 (Stephenson, 1994).

A wolf predation control program in GMU 19A was initiated on July 1, 2004. The program authorizes airborne and same-day airborne shooting to decrease the wolf population in GMU 19A by 80 percent over the next five years. The program was developed to decrease wolf predation on moose calves in order to meet the management and harvest objectives for moose in the area (Alaska Board of Game, 2004).

f. Furbearers

The Holitna Basin provides excellent habitat for many species of furbearers including otter, red fox, marten, wolverine, lynx, muskrat, snowshoe hare, and beaver (ADNR and ADF&G, 1987; Boudreau, 2004):

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 (Solf and Golden, 1994).

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 riverbanks or lodges in slower 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 (Shepherd, 1994).

Martens (*Martes americana*) occupy ranges from 1 to 15 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 (Shepherd and Melchior, 1994).

Red foxes (*Vulpes vulpes*) prefer lowland marshes, hills, and gullies. Foxes live in dens 15 to 20 feet long underground, commonly with several entrances. Foxes are omnivores, relying on a diverse food supply: muskrats, squirrels, hares, birds, eggs, insects, plants, carrion, and voles (Jennings, 1994).

Trapper questionnaires submitted to the ADF&G indicate that populations of beaver, river otter, wolverine, marten, and mink were all common to abundant for regulatory year 1999 (July 1, 1999, to June 30, 2000). Muskrat populations in GMU 19 declined in 1975 and have not rebounded since; trappers reported muskrats as scarce in regulatory year 1999. Red fox populations were reported to be increasing in regulatory year 1999 (Lenart, 2001).

4. Threatened and Endangered Species

Thirteen animal populations and one plant species are listed as threatened or endangered in Alaska. The Holitna Basin is not within the known ranges of any of the listed species (USFWS, 2009).

Chapter Four: Current and Projected Uses of the Holitna Basin License Area

Table of Contents

Page

A. Kuskokwim Area Plan 4-1
B. Boroughs or Census Areas and Communities Within and Near the License Area 4-1
1. Bethel Census Area 4-1
2. Aniak 4-1
3. McGrath 4-3
4. Crooked Creek 4-3
5. Chuathbaluk 4-3
6. Sleetmute 4-4
7. Takotna 4-4
8. Stony River 4-4
9. Red Devil 4-5
10. Lime Village 4-5
11. Georgetown 4-5
12. Napaimute 4-5
C. Subsistence 4-5
D. Sport Harvest Activities 4-11
1. Hunting and Trapping 4-11
2. Sport Fishing 4-15
E. Tourism 4-15

List of Tables

Table **Page**

Table 4.1. Subsistence harvests from communities of the Holitna Basin area, by category. 4-9
Table 4.2. Escapements of Chinook, chum, and coho salmon to the Holitna River, 2001-2003. 4-11
Table 4.3. Harvests of the Mulchatna caribou herd in GMUs 9B, 17, 18 south, 19A, and 19B, 1992-2002. 4-12
Table 4.4. Caribou harvests from the McGrath area, by herd, for GMUs 19A-D, 21A, and 21E, 1989-2002. 4-12
Table 4.5. Reported moose harvest, by residency, in GMUs 19A and 19B, 1994-2003 4-13
Table 4.6. Harvest of brown bear in GMU 19, by subunit, 1989-2000 4-13
Table 4.7. Harvest of wolves in GMU 19, by subunit, 1985-2002. 4-14
Table 4.8. Harvest of furbearers in GMU 19, by subunit, 1995-2000 4-14
Table 4.9. Sport fish harvest and effort, by species, on the Holitna River, 1990-2000 4-15

List of Figures

Figure		Page
Figure 4.1.	Boroughs or census areas and communities of the Holitna Basin.	4-2
Figure 4.2.	Subsistence uses in the Holitna Basin area.	4-8
Figure 4.3.	Harvest of wild foods in Alaska, by census area.	4-9
Figure 4.4.	Subsistence salmon harvests during 1989-2000, Kuskokwim River communities, Bethel Census Area.	4-10

Chapter Four: Current and Projected Uses of the Holitna Basin 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. Holitna Basin area provides habitat for moose, black and brown bear, caribou, waterfowl, and fish species that form the resource base for subsistence, and sport fishing, hunting and gathering. Residents and visitors use the area for recreation and tourism. This section describes current uses in and near the license area. Unless otherwise stated below, projected uses of the license area is anticipated to be a continuation of current uses.

A. Kuskokwim Area Plan

The Kuskokwim Area Plan (KAP) (ADNR and ADF&G, 1987; Figure 3.1) describes how ADNR will manage state land in the Kuskokwim River Basin and part of the Innoko River Basin. The plan balances competing interests in state lands in the Kuskokwim area and contributes to ADNR's statewide goals in a manner appropriate to the resources, economy, and communities of the area. The emphasis of state land management in the Holitna management unit is protection of the fish and wildlife habitat, and support for continued subsistence, commercial, and sport use of these resources. However, among the plan's goals are also economic development and making coal, oil and gas, and geothermal resources available to contribute to national and state energy and mineral supplies and independence. All state lands within the planning area are available for oil and gas exploration and leasing. The plan provides guidelines for oil and gas development, including exploration techniques that minimize clearing, removal of abandoned facilities, pipeline design, and worker education.

B. Boroughs or Census Areas and Communities Within and Near the License Area

Boroughs or census areas and communities within and near the license area are shown in Figure 4.1.

1. Bethel Census Area

The Bethel Census Area occupies 41,087 square miles in Southwestern Alaska and had a population of 16,774 in 2003. The population is 82 percent Alaska Native, primarily Yup'ik Eskimos. The main economies are commercial fishing, tourism, mining, and the federal government. Decreases in fish runs since 1995 have reduced the economic base by 33 percent.

The town of Bethel, with a population of 5,888, serves as the area's main hub and provides transportation, retail trade, and medical services. Bethel's transition to a cash economy is evidenced by the annual pounds of subsistence harvest consumed per person, 260 pounds, compared to 400-800 pounds for the surrounding communities (ADCED, 2004b).

2. Aniak

Aniak (population 551) is located on the Kuskokwim River at the head of Aniak Slough, approximately 80 miles west of Sleetmute. Aniak was an abandoned Yup'ik village when Tom L. Johnson homesteaded the site in 1914. The Native community was reestablished soon after when Yup'ik Eskimos returned from Ohagamuit. Aniak became an incorporated city in 1972. The Village of Aniak is the only federally recognized tribe in Aniak.

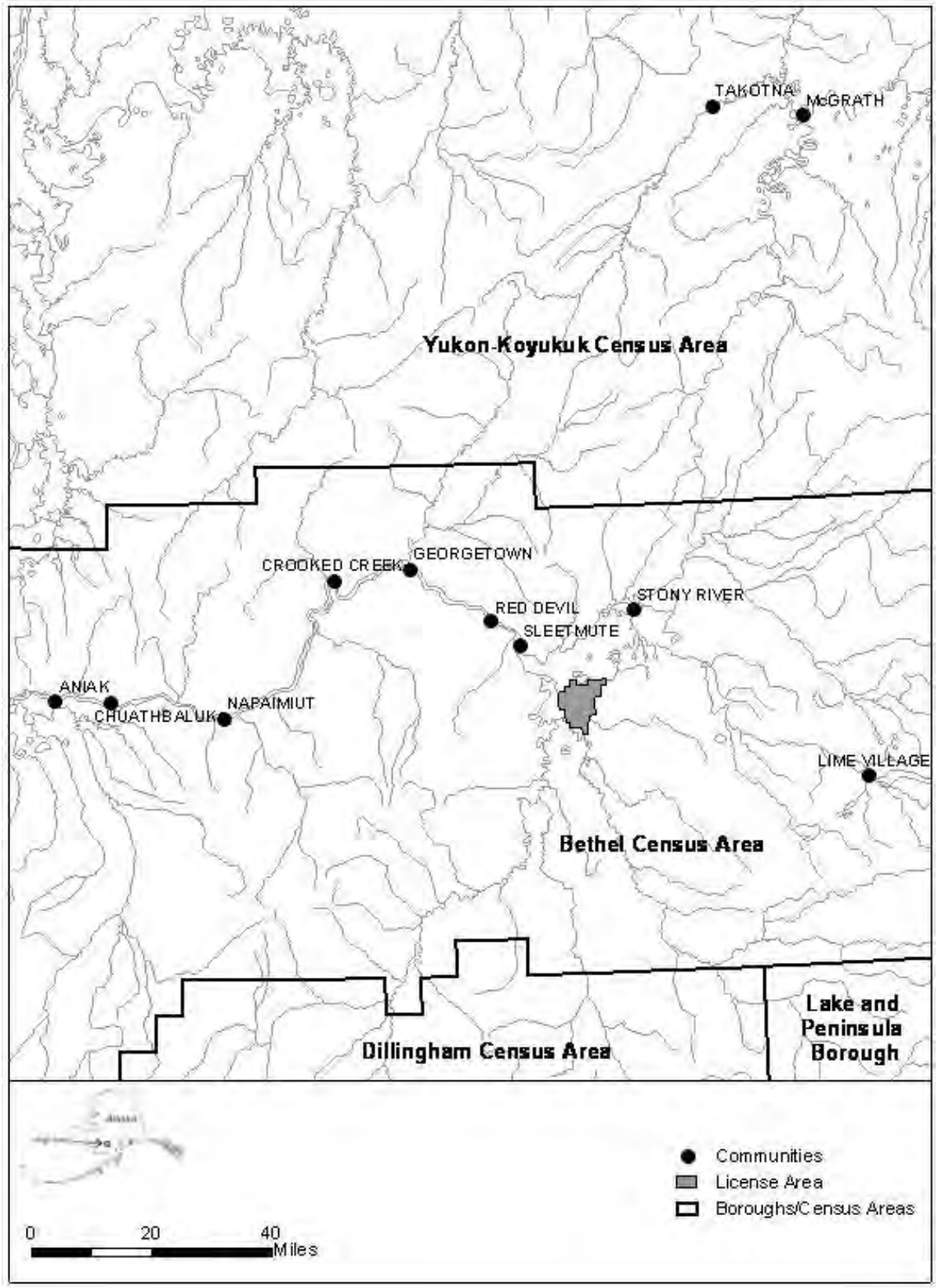


Figure 4.1. Boroughs or census areas and communities of the Holitna Basin.

The community is 73 percent Alaska Native or part Native, consisting of Yup'ik Eskimos and Tanaina Athabascans. The primary employers in the village are the school district, Kuskokwim Native Association, Bush-Tell Inc., and the Aniak Subregional Clinic. Poor fish returns since 1997 have affected commercial fishing, and only 14 residents currently hold permits. Subsistence activities provide for the majority of villagers' food.

Due to its size, Aniak is considered a service hub for surrounding villages. The airport consists of a 6,000-foot-long asphalt runway. Road access to other villages is nonexistent, although Aniak is also accessible by floatplane via Aniak Slough or by snowmachine along trails and frozen rivers in the winter (ADCED, 2004a).

3. McGrath

McGrath (population 415) is located approximately 100 miles northeast of Sleetmute on the Kuskokwim River just south of its confluence with the Takotna River. The McGrath old town site was originally a seasonal meeting place for Upper Kuskokwim Athabascan villages in the area. A town was established in 1907 and named after a local U.S. marshal. The city became incorporated in 1975. Two tribes exist in the village: the McGrath Native Village, which is federally recognized, and the Medfra Traditional Council, which is not federally recognized.

The population is 55 percent Alaska Native or part Native. McGrath serves as a regional center because of its size and its location at the farthest upstream section of the Kuskokwim River accessible by large riverboats. The village economy includes transportation, communications, and supplies.

No roads exist to nearby villages, although winter trails exist to Nikolai and Takotna. Air transportation facilities include a seaplane base on the Kuskokwim River and a 5,435-foot-long asphalt runway with a 1,720-foot-long crosswind landing strip (ADCED, 2004a).

4. Crooked Creek

Crooked Creek (population 146) is located 27 miles northwest of Red Devil on the Kuskokwim River at its confluence with Crooked Creek. Crooked Creek served as a summer fish camp for nearby villagers in the 1800s. A permanent camp was established in 1909 to serve miners en route to the Flat and Iditarod gold mining camps.

The Native Village of Crooked Creek is the only federally recognized tribe in the village. The population is 93 percent Alaska Native or part Native, consisting of Yup'ik Eskimo and Ingalik Athabascans. The school and store are the only employment resources; however a feasibility study is currently being conducted for a large gold mining operation on Donlin Creek, just north of Crooked Creek. Subsistence activities are the primary source of food. Although Crooked Creek has a 1,997-foot-long gravel airstrip, the primary forms of access are boat in summer and ice road in winter (ADCED, 2004a).

5. Chuathbaluk

Chuathbaluk (population 102) is located 11 miles upstream from Aniak on the Kuskokwim River. The village was originally an Ingalik Indian summer fish camp in the mid-1800s. A Russian Orthodox mission was built in 1894, which attracted residents from nearby villages. An influenza epidemic struck the village in 1900 and the community was not reestablished until 1954. Chuathbaluk became an incorporated city in 1975.

The Chuathbaluk Traditional Council is the only federally recognized tribe in the community. The community is 94 percent Alaska Native or part Native, consisting of Yup'ik Eskimos and Tanaina Athabascans. Employment opportunities are through the school, tribal government, city, clinic, and seasonal Bureau of Land Management (BLM) firefighting. One resident holds a commercial fishing

permit. Residents are dependent upon subsistence activities for food. A 1,560-foot-long gravel airstrip allows access to the village, and the Kuskokwim River, when frozen, may be used for ski-plane landings and as an ice road to nearby villages (ADCED, 2004a).

6. Sleetmute

Sleetmute (population 72) is located about 10 miles outside the license area, on the north side of the Kuskokwim River, 1.5 miles north of its confluence with the Holitna River. The village was founded by Ingalik Indians and named after the slate deposits located nearby. The Sleetmute Traditional Council is the only federally recognized tribe in the community. The population is 89 percent Alaska Native or part Native, consisting of Ingalik Indians.

The economy is based on seasonal work that includes BLM firefighting, trapping, and cannery work in other villages. The primary employer in the village is the school, and one resident holds a commercial fishing permit. Subsistence activities supplement local incomes, and many residents travel to fish camps in the summer.

One 3,100-foot-long gravel airstrip exists in the village. The river is used for transportation and supplies in the summer, and snow machines travel the frozen river in winter (ADCED, 2004a). Sleetmute residents use groundwater from a central community well and from individual wells for their drinking water.

7. Takotna

Takotna (population 63) is located 17 miles by air west of McGrath on the Takotna River. The community was established in 1908 at the farthest point accessible by paddle steamer in order to provide supplies to miners in the Innoko region. Roads were constructed to both Ophir and the Kuskokwim River. Takotna was replaced by McGrath as a major supply center in the 1930s.

Takotna Village is the only federally recognized tribe in the community. The population is 42 percent Alaska Native or part Native, consisting of Ingalik Athabascans and Eskimos. Employment opportunities in the village include the school district, post office, clinic, local businesses, and seasonal construction. Most residents rely on subsistence activities for food.

Two gravel runways exist in the vicinity of Takotna: one 1,717-foot-long gravel airstrip at Takotna and one 3,800-foot-long gravel runway at the Tatalina Air Force Station, which is 10 miles southeast of the village.

Eighty miles of local roads extend to the Tatalina Air Force Station, Sterling Landing, and existing mines. Cargo is offloaded at Sterling Landing, which is 24 miles southeast of Takotna on the Kuskokwim River (ADCED, 2004a).

8. Stony River

Stony River (population 49) is located on the Kuskokwim River two miles north of its confluence with the Stony River. The village first operated as a trading post and landing in order to supply mining operations to the north. Alaska Natives established year-round residency in the early 1960s. The Village of Stony River is the only federally recognized tribe in the community. The population is 85 percent Alaska Native or part Native, consisting of Athabascan Indians and Yup'ik Eskimos.

Few opportunities for employment exist in Stony River. BLM firefighting provides seasonal income, and residents depend primarily on subsistence activities. A 2,601-foot-long gravel airstrip exists; additional access to the community is by riverboat in the summer and snow machine in the winter (ADCED, 2004a).

9. Red Devil

Red Devil (population 41) is located about six miles northwest of Sleetmute on the Kuskokwim River at the mouth of Red Devil Creek. The village was named and established after the Red Devil Mine, a former mercury mine in the nearby Kilbuck-Kuskokwim Mountains. The mine operated from 1921 until 1971. The Red Devil Traditional Council is the only federally recognized tribe in the community. The population is 52 percent Alaska Native or part Native, consisting of Yup'ik Eskimos and Tanaina Athabascans.

Employment since the mine closed depends on seasonal BLM firefighting and commercial fishing; incomes are supplemented by subsistence activities. A 4,801-foot-long gravel airstrip provides year-round access (ADCED, 2004a).

10. Lime Village

Lime Village (population 34) is located on the Stony River 50 miles southeast of its confluence with the Kuskokwim River. The area was used as a summer fish camp by Lake Clark residents, and the earliest recorded settlement was in 1907.

The Lime Village Traditional Council is the only federally recognized tribe in the community. Census information lists 95 percent of the population as Alaska Native or part Native, consisting of Denaina Athabascans. The economy consists of trapping and seasonal firefighting through BLM; subsistence activities provide food for residents.

Access is by small riverboats or planes, which use the 1,500-foot-long gravel airstrip in the village; barges cannot access the community due to shallow water (ADCED, 2004a).

11. Georgetown

Georgetown (population 3) is located 16 miles northwest of Red Devil on the Kuskokwim River east of the mouth of the George River. Georgetown was a summer fish camp for residents from nearby villages in the 1800s and turned into a mining settlement when gold was discovered in the George River in 1909. The mining community boomed to 300 prospectors until fire destroyed most of the cabins in 1911. The present settlement developed in the 1950s.

The Native Village of Georgetown is the only federally recognized tribe in the community. The population is 100 percent Alaska Native or part Native and consists of Yup'ik Eskimos and Tanaina Athabascans. Subsistence is the only resource base, and no residents are employed. River access to Georgetown is available year-round, and aircraft may land in the wintertime (ADCED, 2004a).

12. Napaimute

Napaimute is a seasonal use area located 28 miles east of Aniak on the Kuskokwim River. The village is no longer populated but is used seasonally as a subsistence camp and as a summer fish camp. A community settled around a trading post that had been established in 1906, but most residents moved to nearby villages by the 1950s. Access and supplies are brought by riverboat and barge service in the summer and by ice road on the river in the winter (ADCED, 2004a).

C. Subsistence

Subsistence is part of the culture, tradition, and economy of many families and communities throughout Alaska. State and federal law define subsistence as the customary and traditional, noncommercial uses of wild resources for a variety of purposes. Food is one of the most important subsistence uses of wild resources; however, wild resources also are harvested and processed for these important subsistence uses (ADF&G, 2000):

- **Clothing**: Wild furs and hides are still the best materials for ruffs (wind guards), mitts, parkas, kuspuks, clothes lining, and mukluks (winter boots) in many regions.
- **Fuel**: Wood is a major source of energy in rural homes and is used for smoking and preserving fish and meat.
- **Transportation**: Fish, seals, and other products are used to feed dog teams.
- **Construction**: Spruce, birch, hemlock, willow, and cottonwood are used for house logs, sleds, fish racks, and many other items.
- **Home goods**: Hides are used as sleeping mats. Sealskins are used as pokes to store food. Wild grasses are made into baskets and mats.
- **Sharing**: Fish and wildlife are widely given out to support neighbors who cannot harvest for themselves because of age, disability, or other circumstances.
- **Customary trade**: Specialized products like seal oil are bartered and exchanged in traditional trade networks between communities. Furs sold to outside markets provide an important source of income to many rural areas.
- **Ceremony**: Traditional products are used in funerals, potlatches, marriages, Native dances, and other ceremonial occasions.
- **Arts and crafts**: Ivory, grass, wood, skins, and furs are crafted into beautiful items for use and sale.

The State of Alaska, through the Boards of Fisheries and Game, manages subsistence resources on all lands and waters in Alaska. The license area falls within ADF&G GMU 19A. The federal government, through the Federal Subsistence Board, is responsible for assuring a federal subsistence priority on federal public lands and waters. Since 1989, the federal and state laws governing subsistence in Alaska have differed. Due to this discrepancy, subsistence is managed differently on state and federal lands.

Title VII of the Alaska National Interest Lands Conservation Act established the federal subsistence program. Federal regulations grant priority to subsistence users over commercial or sport users during times of resource shortage. Only residents of rural communities are eligible for subsistence uses under the federal subsistence program.

Under the state subsistence program, 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."

The Holitna River, Hoholitna River, and Basket Creek drainages along with Big Lake are important subsistence use areas for residents of Sleetmute and surrounding villages. Sleetmute residents reported using the Holitna River and Hoholitna River corridors for hunting moose and bears while Chuathbaluk residents only identified using the Holitna River corridor for moose hunting, according to a 1984 Division of Subsistence report examining subsistence use and hunting areas for the villages of Sleetmute and Chuathbaluk. Sleetmute residents also identified the area between the Stony River and Holitna River that encompasses the license area as an area for hunting caribou (Charnley, 1984). The Holitna River corridor and the Big Lake-Basket Creek area to the east were identified by Sleetmute residents as trapping areas. Other subsistence uses along the Holitna River include fishing

for whitefish, burbot, pike, and other resident fish; salmon fishing; and berry picking (Charnley, 1984; McLean, 2004). Sleetmute residents identified the Big Lake-Basket Creek area as important for harvesting many subsistence resources, including whitefish, migratory birds, caribou, and moose (McLean, 2004). Whitefish in the Holitna Basin are likely to support subsistence harvests throughout the Kuskokwim Basin. Sheefish in the Holitna River drainage are also probably contributing to subsistence throughout the Kuskokwin Basin (ADF&G, 2005a).

Stony River residents have reported that the Holitna River corridor is used for hunting moose, black bear, and waterfowl, and also for trapping. The areas between the Stony River and Holitna River corridors, including Big Lake, Basket Creek, and the license area, are used for hunting moose, caribou, and waterfowl as well as for trapping. Big Lake and Basket Creek also are identified specifically as plant harvest areas (Kari, 1985; McLean, 2004).

A preliminary summary of the September 2005 Tier 1 registration permit moose hunt data showed 392 permits (36 percent) went to GMU 19A residents, 655 permits (60 percent) were issued to GMU 18 and other Kuskokwim area village (Nikolai and McGrath) residents, and 39 permits (4 percent) were issued to residents living elsewhere in the state. This summary and other sources together demonstrate the long-term, consistent use of GMU 19A by residents of the Central Kuskokwim and Lower Kuskokwim River communities for a wide range of resource harvest activities (Krauthoefer and Haynes, 2005).

Communities in the Bethel Census Area consumed 9.48 million pounds of subsistence resources in 2000. The average annual subsistence harvest was 598 pounds per person, which is the fourth highest per capita consumption of subsistence harvest for census areas in the state (ADCED, 2004b).

In an effort to include local area knowledge of the Holitna Basin, DO&G solicited input from area residents and elders in order to identify significant area landmarks, local subsistence harvest areas, and Native allotment sites. Pete Mellick, president of the Traditional Council in Sleetmute, provided assistance in identifying the local landmarks and subsistence harvest areas. Figure 4.2 illustrates 15 landmark locations near the Holitna area. Most landmarks are located south of the license area (Mellick, 2005).

The Division of Subsistence provided data for Chuathbaluk, McGrath, and Sleetmute. Residents in McGrath utilized the least amount of subsistence resources, approximately 181 pounds per person. Sleetmute residents consumed 402 pounds per person, and Chuathbaluk residents consumed 786 pounds per person (Scott et al., 2001). See Table 4.1 and Figure 4.3.

Salmon are an important subsistence resource for communities along the Kuskokwim River (Figure 4.4). Chinook and chum salmon are the most important species, and the subsistence harvest of Chinook salmon in the Bethel Census Area is the largest in the state (ADCED, 2004b). Subsistence users alone harvested 80,000 Chinook salmon in each of the past two years. This represents 50 percent of the total statewide subsistence harvest of Chinook (KRSMWG, 2005).

The Kuskokwim River has two commercial salmon fishing districts. District 1, or the Lower Kuskokwim district, extends from the river mouth to a point below Lower Kalskag. District 2, or the Middle Kuskokwim district, starts below Lower Kalskag and ends upstream at Chuathbaluk. District 2 has been closed to commercial fishing since 2001. No commercial fishing districts extend into the area of the Kuskokwim River adjacent to the license area. The most important commercial salmon species is coho salmon, followed by chum salmon. Directed commercial fishing for Chinook salmon was discontinued in 1987 to meet the needs of subsistence users (Stroka and Brase, 2004).

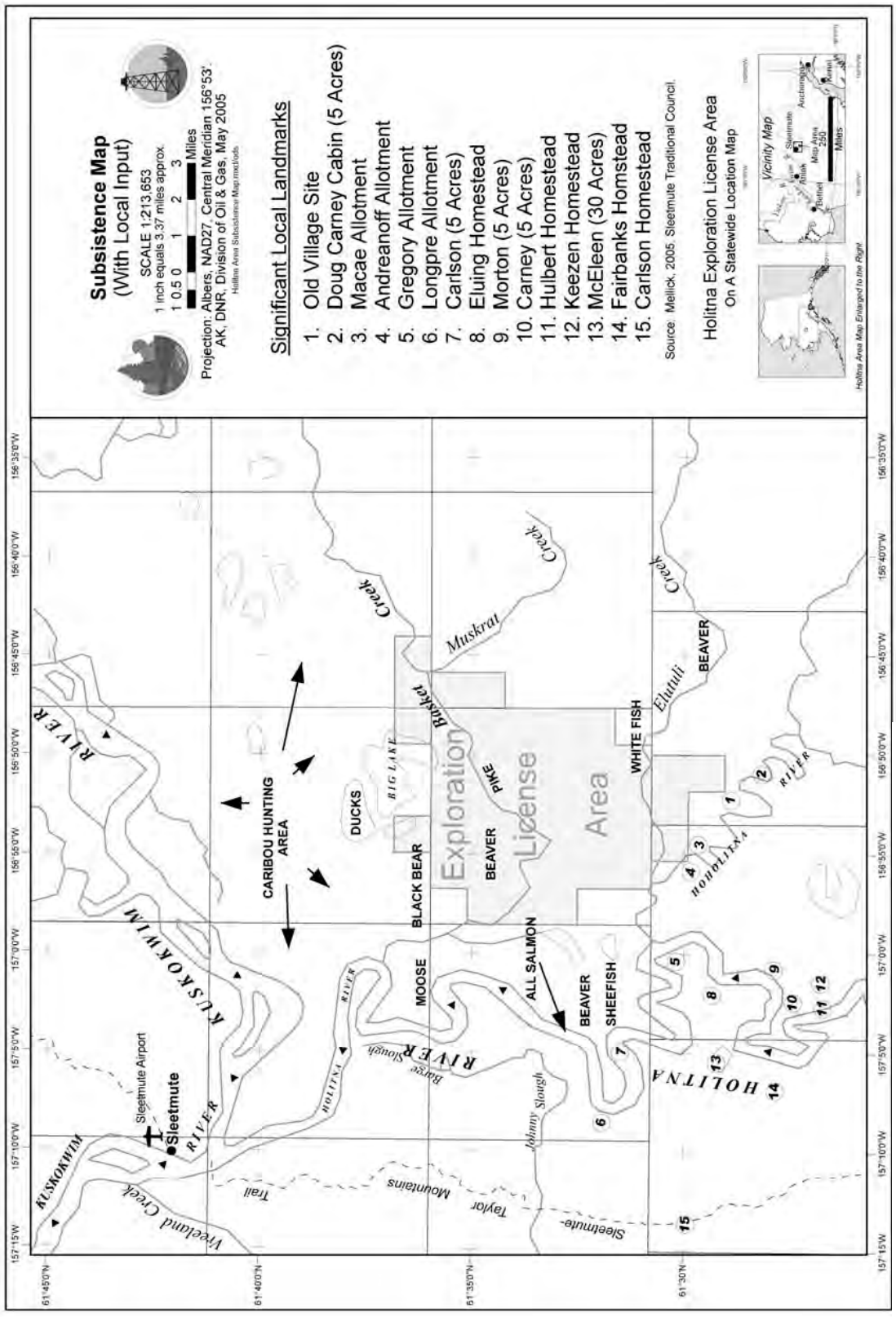
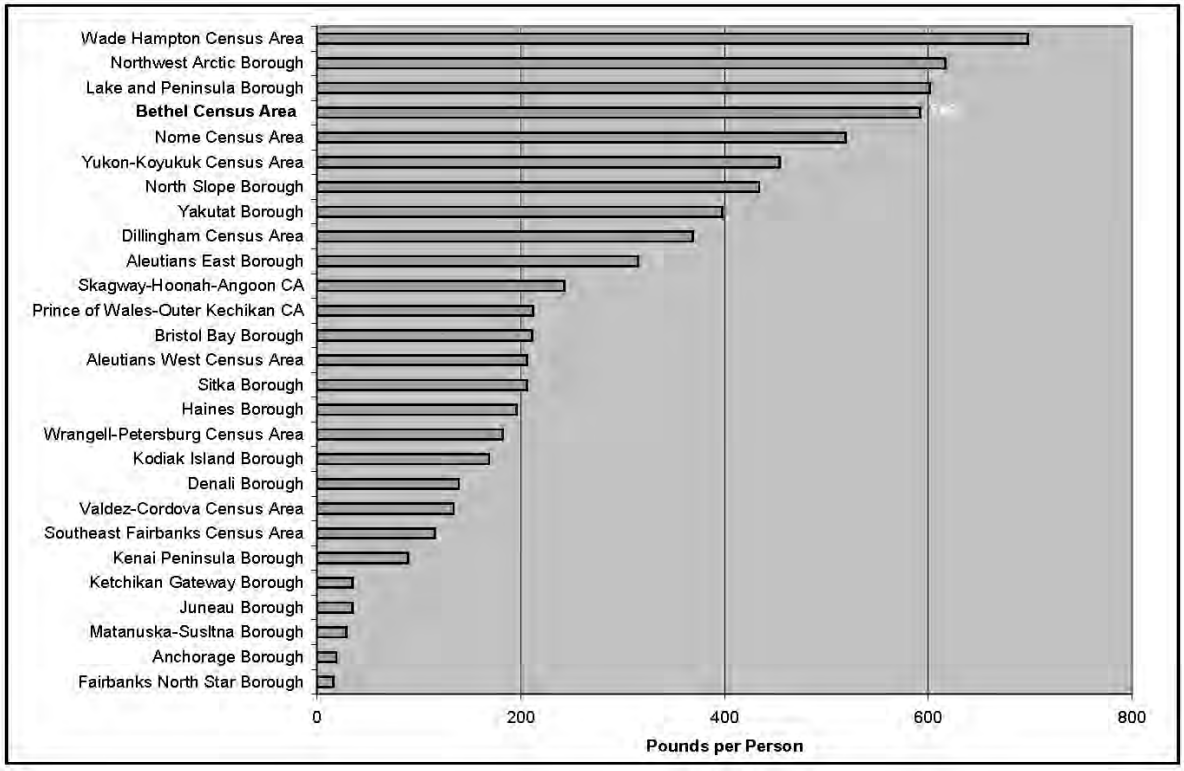


Figure 4.2. Subsistence uses in the Holitna Basin area.

Table 4.1. Subsistence harvests from communities of the Holitna Basin area, by category.

Community	Year	Salmon	Other Fish	Land Mammals	Birds and Eggs	Vegetation	Total
McGrath	1984	75.37	19.48	77.28	7.69	2.02	181.84
Chuathbaluk	1983	613.72	NA	113.26	NA	NA	726.98
Sleetmute	1983	211.00	NA	191.09	NA	NA	402.09

Notes: Units are pounds usable weight per person. NA = no information available.



Source: Scott et al. 2001.

Figure 4.3. Harvest of wild foods in Alaska, by census area.

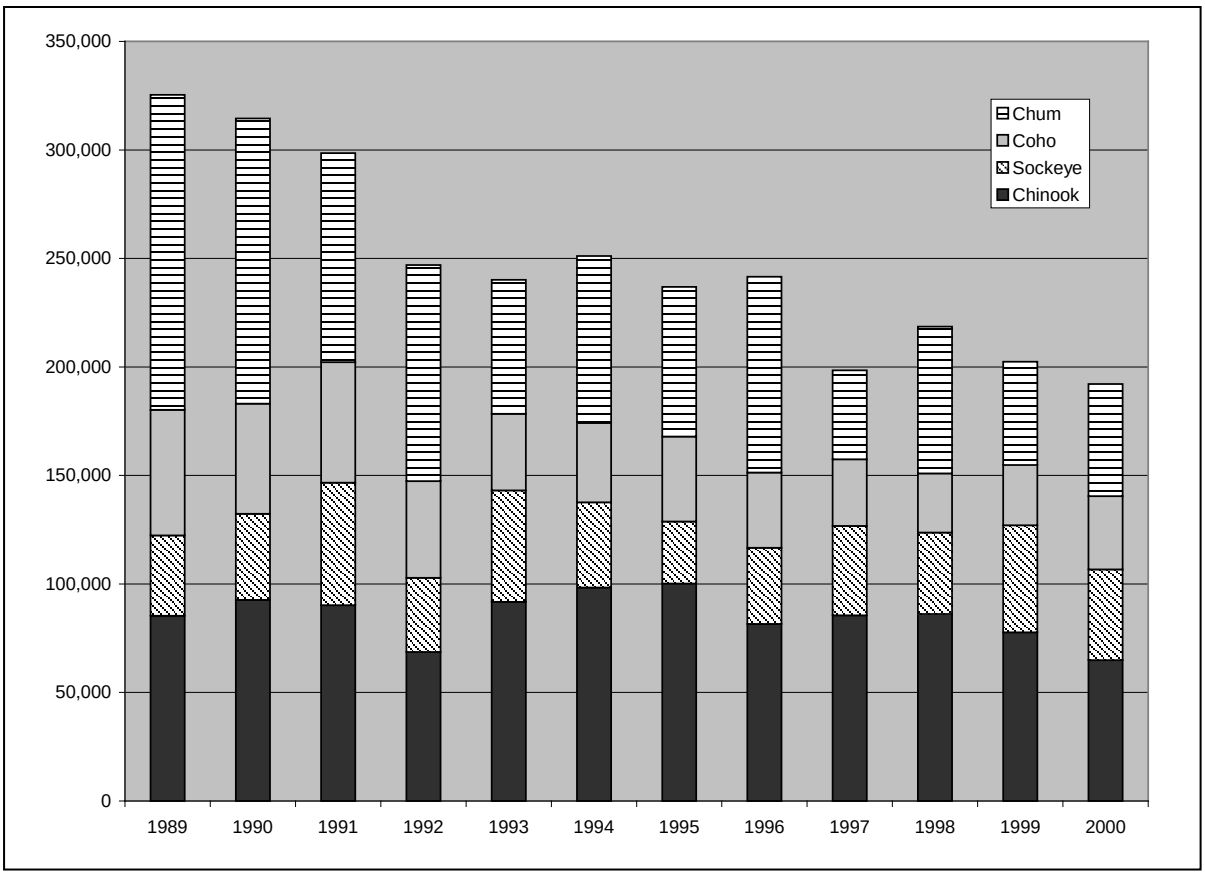


Figure 4.4. Subsistence salmon harvests during 1989-2000, Kuskokwim River communities, Bethel Census Area.

The Holitna and Hoholitna rivers adjacent to the license area are considered important salmon producing areas that support subsistence and commercial fisheries along the middle and lower Kuskokwim River (McLean, 2004). ADF&G monitors catch and escapement at the Kogrukluk River weir, located in the upstream reaches of the Holitna River. Table 3.6 shows the escapement for all five salmon species at the weir during 1994-2004. Estimates of Chinook, chum, and coho salmon escapements in the Holitna River are provided in Table 4.2 (Stroka and Brase, 2004).

The lower escapement in 2001 is at the end of a span of years that had exceptionally low Chinook run abundance throughout much of Western Alaska and therefore should be considered as representing the low end of the subbasin's potential Chinook salmon production. In 2002, the Holitna-Hoholitna Subbasin stocks accounted for 43 percent of the 100,733 Kuskokwim River Chinook salmon passing upstream from Aniak (Stuby, 2003; OHMP, 2004).

Two commercial fishing licenses are held by residents in the 10 communities upstream from Aniak. In the community of Aniak, 14 out of 551 residents hold commercial fishing licenses. Poor runs in the Kuskokwim River since 1997 have impacted the fishing industry for Kuskokwim communities (ADCED, 2004a).

Table 4.2. Escapements of Chinook, chum, and coho salmon to the Holitna River, 2001-2003.

Species	Year		
	2001	2002	2003
Chinook	25,405	42,902	42,013
Chum	NA	542,172	NA
Coho	63,442	157,277	NA

Source: Stroka and Base 2004.

D. Sport Harvest Activities

Sport harvest activities in the vicinity of the license area include hunting, trapping, and sport fishing.

1. Hunting and Trapping

The license area is located in GMU 19A (see Figure 3.4). The major big game species harvested in the area are moose and caribou. The sections of the Holitna and Hoholitna rivers extending two miles on either side are closed to caribou hunting for nonresidents. Resident hunters harvest an average of five caribou annually in the license area (McLean, 2004). The average annual harvest of the Mulchatna caribou herd over the last five years has been approximately 8,400 animals (Woolington, 2003). Table 4.3 and Table 4.4 show the annual harvests from caribou herds in GMU 19.

Declining moose populations in GMU 19 have led to more restrictive moose hunting regulations. Currently, all of GMU 19A is closed to moose hunting by nonresidents, and resident hunters are restricted to a fall season moose hunt for antlered bulls by registration only. Average annual harvest is 25 moose in the license area (McLean, 2004). Nonlocal resident hunters harvested the most moose in 19A for the years 1994-2003, although the actual moose harvest in rural areas is expected to be 50 to 72 percent greater than reported (Table 4.5).

Brown bears, wolves, and furbearers also are harvested in GMU 19. The average annual brown bear harvest for GMU 19A is 7 bears (Table 4.6). The average annual wolf harvest for the period 1997-2002 in GMU 19A is 30 wolves (Table 4.7). A wolf control program was initiated in 2004 to reduce predation on the declining moose population. The Alaska Board of Game established airborne and same-day airborne shooting of wolves in GMU 19A to reduce the population by 80 percent during a period of five years starting July 1, 2004 (Alaska Board of Game, 2004). Furbearer harvests for GMU 19 during 1995-2000 are included in Table 4.8. Beavers are the most important furbearer harvested in GMU 19A, and harvest ranged from 3 to 222.

Table 4.3. Harvests of the Mulchatna caribou herd in GMUs 9B, 17, 18 south, 19A, and 19B, 1992-2002.

Year	Reported [a]	Estimated	Total
1991-1992	1,573	1,700	3,273
1992-1993	1,602	1,800	3,402
1993-1994	2,804	2,000	4,804
1994-1995	3,301	2,700	6,001
1995-1996	4,449	2,800	7,249
1996-1997	2,366	2,200	4,566
1997-1998	2,704	2,400	5,104
1998-1999[b]	4,770	5,000[c]	9,770
1999-2000	4,467	5,000[c]	9,467
2000-2001	4,004	5,000[c]	9,004
2001-2002	3,826	5,000[c]	8,826
5-year average	3,954	2,400	8,434

a Includes only reported harvest from harvest cards.

b First year that reminder letters were sent to caribou hunters.

c Includes minimum suspected unreported harvest from GMU 18.

Source: Woolington 2002.

Table 4.4. Caribou harvests from the McGrath area, by herd, for GMUs 19A-D, 21A, and 21E, 1989-2002.

Year	Beaver Mountains	Sunshine Mountains	Farewell-Big River	Rainy Pass	Tonzona	Unspecified	Total
1989-1990	12	2	49	84	12	9	168
1990-1991	5	2	72	115	15	2	211
1991-1992	13	0	65	101	37	1	217
1992-1993	4	2	51	62	5	2	126
1993-1994	3	1	61	35	15	19	134
1994-1995	2	0	82	57	25	6	172
1995-1996	1	0	55	30	13	3	101
1996-1997	5	0	35	42	12	1	95
1997-1998	0	0	44	24	11	2	81
1998-1999	5	0	35	28	13	21	102
1999-2000	3	0	41	24	11	26	105
2000-2001	3	0	25	26	8	20	82
2001-2002	2	4	31	16	6	10	69

Notes: Excludes Mulchatna caribou herd animals taken in Unit 19.

Source: Boudreau 2003.

Table 4.5. Reported moose harvest, by residency, in GMUs 19A and 19B, 1994-2003.

Year	Local resident hunters	Nonlocal resident hunters	Nonresident hunters	Total Harvest [a, b]
GMU 19A				
1994-1995	56	82	23	168
1995-1996	28	83	23	141
1996-1997	42	119	20	184
1997-1998	44	77	19	142
1998-1999	56	65	19	146
1999-2000	45	46	20	117
2000-2001	18	53	32	108
2001-2002	22	53	11	95
2002-2003	19	29	18	67
GMU 19B				
1994-1995	0	71	88	163
1995-1996	0	66	69	136
1996-1997	0	54	107	166
1997-1998	0	41	114	159
1998-1999	0	48	100	153
1999-2000	1	43	59	112
2000-2001	0	60	88	153
2001-2002	1	42	68	112
2002-2003	1	14	65	81

[a] Includes reports with "unknown" residency.

[b] Harvest reporting is low in many areas of rural Alaska. Actual harvest in rural areas is estimated to be 50 to 72 percent greater than reported harvest.

Source: ADF&G 2004b.

Table 4.6. Harvest of brown bear in GMU 19, by subunit, 1989-2000.

Year	Subunit			
	19A	19B	19C	19D
1989-1990	0	15	16	3
1990-1991	2	15	14	7
1991-1992	4	18	9	2
1992-1993	11	28	15	4
1993-1994	4	25	14	1
1994-1995	8	26	16	2
1995-1996	7	30	18	2
1996-1997	9	13	19	2
1997-1998	10	27	25	0
1998-1999	6	36	24	5
1999-2000	13	39	23	5
Annual Average	7	25	18	3

Source: Boudreau 2001a.

Table 4.7. Harvest of wolves in GMU 19, by subunit, 1985-2002.

Year	Subunit			
	19A	19B	19C	19D
1985–1986	2	1	6	31
1986–1987	8	16	22	29
1987–1988	55	56	13	15
1988–1989	6	32	40	32
1989–1990	26	46	41	21
1990–1991	41	11	44	32
1991–1992	20	22	49	20
1992–1993	14	5	11	3
1993–1994	6	19	37	22
1994–1995	45	42	61	38
1995–1996	23	27	19	18
1996–1997	13	19	33	42
1997–1998	14	14	7	30
1998–1999	43	39	14	20
1999–2000	21	28	24	39
2000–2001	25	38	16	37
2001–2002	46	55	28	29
5-year average	30	35	18	31

Source: Szepanski 2003.

Table 4.8. Harvest of furbearers in GMU 19, by subunit, 1995-2000.

Year	Subunit				
	19A	19B	19C	19D	Total [a]
Beaver					
1995-1996	3	11	2	64	80
1996-1997	222	16	0	159	421
1997-1998	77	15	0	116	208
1998-1999	12	5	2	35	54
1999-2000	17	13	0	57	87
Lynx					
1995-1996	0	1	8	2	11
1996-1997	7	0	3	13	24
1997-1998	1	2	1	5	9
1998-1999	1	0	6	5	12
1999-2000	1	22	6	2	31
River Otter					
1995-1996	0	5	0	1	6
1996-1997	30	5	0	15	50
1997-1998	8	4	0	4	16
1998-1999	4	1	0	1	6
1999-2000	8	7	0	0	15
Wolverine					
1995-1996	5	16	14	2	37
1996-1997	9	26	19	20	76
1997-1998	5	17	6	4	38
1998-1999	6	22	9	5	43
1999-2000	10	22	15	15	62

[a] Includes harvest for which subunit was not reported.
Source: Lenart 2001.

2. Sport Fishing

Sport fishing and personal use seasons and bag, possession, and size limits in the license area are regulated under the Kuskokwim-Goodnews Bay Management Area (5 AAC 70.017). A 2000 ADF&G, Division of Sport Fish survey on the Middle Kuskokwim Chinook sport fishery reported that, of 123 anglers interviewed, 74 percent were guided, and 80 percent of the guides were local residents from Sleetmute, Red Devil, or Crooked Creek (Burr, 2002). The survey was conducted on the middle Kuskokwim River from the mouth of the Oskawalik River to the mouth of the Tatlawiksuk River and included the lower 55 miles of the Holitna River. Chinook salmon were the primary species targeted by anglers, followed by northern pike and sheefish (Burr, 2002). Table 4.9 shows the fishing effort, harvests, and catch for several fish species on the Holitna River during 1990-2000. Estimates of catch include fish harvested and fish released.

Table 4.9. Sport fish harvest and effort, by species, on the Holitna River, 1990-2000.

	Year										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fishing Effort [a]	398	1,022	480	763	949	640	747	1,678	771	1,236	791
Harvest											
Chinook	–	–	23	68	40	19	256	166	54	25	22
Chum	14	119	91	208	–	–	33	–	–	–	–
Sockeye	–	–	–	43	–	–	–	21	–	–	12
Coho	12	205	130	–	–	170	157	379	–	893	426
Arctic Grayling	18	312	23	–	–	184	121	101	124	74	38
Northern Pike	53	504	145	9	155	166	102	134	103	106	112
Sheefish	53	128	173	45	130	113	26	168	35	102	58
Dolly Varden	18	216	–	–	–	52	61	64	25	112	–
Catch											
Chinook	27	–	–	375	110	91	662	786	335	240	22
Chum	101	159	471	881	38	327	230	116	25	135	–
Sockeye	–	–	–	–	–	–	–	64	84	–	124
Coho	122	205	154	–	–	472	939	1,145	–	2,005	1,404
Arctic Grayling	264	1,953	8	372	228	631	615	1,803	8,303	1,016	381
Northern Pike	317	830	752	842	973	1,488	1,427	1,308	1,379	2,146	2,292
Sheefish	158	372	508	1,317	189	472	304	1,098	729	745	512
Dolly Varden	35	3,038	164	1,326	9	430	364	968	305	589	200

[a] Days fished.

Source: Burr 2002.

E. Tourism

Most tourism activities in the Holitna Basin involve hunting and sport fishing. Due to the declining moose population in the area, multiple management decisions have reduced or eliminated hunting opportunities for nonresidents to allow for the continued hunting of moose by subsistence residents. One lodge owner reported that he has not returned to his lodge in the Holitna Basin since restrictions were placed on nonresident hunters in 2002 and that other big-game outfitters operating out of Sleetmute have also closed their businesses (Jameson, 2004). Currently, residents must register at the nearest ADF&G Division of Wildlife Conservation office in the spring to take part in the fall hunting season. This requires two trips for nonlocal residents, which Jameson believes has made hunting at his lodge cost-prohibitive (Jameson, 2004). Until moose populations increase to support both subsistence users and nonlocal resident and nonresident hunters, tourism opportunities for moose hunting in the area will be limited.

Sport fishing opportunities are growing in the Holitna Basin. One sport fishing outfitter on the Holitna River operates two camps: the lower camp is approximately four miles upstream from the confluence of the Holitna and Hoholitna rivers, and the upper camp is a tent camp on leased ADNR land below the confluence of the Kogrukluk, Holitna, and Chukowan rivers (McElveen, 2004). In a survey in 2000, the Division of Sport Fish interviewed 123 Chinook salmon anglers, 74 percent of whom were guided and 83 percent of whom were nonresidents (Burr, 2002). In 2004, six registered sport fishing guiding businesses operated in Aniak, four in Sleetmute, and one in McGrath (ADF&G, 2004c).

Currently, no other tourism activities are supported in the vicinity of the license area. Opportunities in the Bethel Census Area for tourism development beyond sport fishing and hunting include visitor infrastructure and services, ecotourism, bird watching, wildlife viewing, and cultural tourism (ADCED, 2004b).

Chapter Five: Reasonably Foreseeable Effects of Licensing and Subsequent Activity

Table of Contents

Page

Chapter Five: Reasonably Foreseeable Effects of Licensing and Subsequent Activity 5-1
A. Post-Licensing Phases 5-2
1. Exploration 5-3
a. Geophysical Exploration 5-3
b. Exploration Drilling 5-3
2. Development and Production 5-5
B. Statewide and Local Fiscal Effects 5-8
1. Statewide Fiscal Effects 5-8
2. Local Fiscal Effects 5-9
a. Employment 5-10
b. Cost of Living 5-12
C. Municipal and Community Effects 5-13
1. Commercial Fishing 5-13
2. Infrastructure 5-13
3. Land Use 5-13
D. Cumulative Effects 5-14
1. Effects on Water Quality 5-14
2. Effects on Air Quality 5-17
3. Effects on Fish and Wildlife Habitat and Populations and Their Uses 5-17
a. Terrestrial Habitat 5-17
b. Effects on Fish 5-19
c. Effects on Birds 5-20
d. Effects on Terrestrial Wildlife 5-22
i. Caribou and Moose 5-22
ii. Bears 5-23
iii. Wolves 5-23
iv. Furbearers and Other Small Mammals 5-23
v. Mitigation Measures 5-24
4. Effects on Subsistence Uses 5-24
5. Effects on Cultural and Historic Resources 5-24

List of Tables

		Page
Table 5.1.	Potential activities and effects of gas exploration, development, and production.	5-2
Table 5.2.	Some examples of exploration, development, and production phase activities.	5-2
Table 5.3.	Drilling fluid additives.	5-5
Table 5.4.	Average monthly employment in the Bethel census area.	5-10
Table 5.5.	Cost of living comparison for Bethel and Anchorage.	5-12

List of Figures

Figure		Page
Figure 5.1.	Evolving consolidation of North Slope production pad size.	5-6
Figure 5.2.	Drill site block diagram.	5-7
Figure 5.3.	Directional drilling applications.	5-7
Figure 5.4.	Average monthly unemployment rate in the Bethel Census Area and Alaska, 2004.	5-11
Figure 5.5.	Per capita personal income, 1979-2002.	5-11

Chapter Five: Reasonably Foreseeable Effects of Licensing and Subsequent Activity

Until discoveries are made, DO&G cannot predict whether or when any gas 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 specific location, type, and other factors unique to the discovery. Best interest findings are not required to speculate about such possible future effects (AS 38.05.035(h)).

However, AS 38.05.035(g) specifies that the following shall be considered and discussed in best interest findings: reasonably foreseeable cumulative effects of exploration, development, production, and transportation for gas on the license area, including effects on subsistence uses, fish and wildlife habitat and populations and their uses, and historic and cultural resources; reasonably foreseeable fiscal effects of the license on the state and affected municipalities and communities; and reasonably foreseeable effects of exploration, development, production, and transportation for gas on municipalities and communities within or adjacent to the license area. This chapter discusses these potential effects.

Potential effects of a gas license can be both positive and negative. Most potentially negative effects on fish and wildlife species, habitats, and their uses, on subsistence uses, and on local communities and residents can be avoided, minimized, or mitigated through mitigation measures. A full listing of mitigation measures can be found in Chapter Seven.

This final 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 (AS 38.05.035(h)). The effects of future exploration, development, or production will be considered at each subsequent phase, when various government agencies and the public review permit applications for the specific activities proposed at specific locations in the license area.

It is important to note that all post-licensing activities are also subject to numerous local, state, and federal statutes, regulations, and ordinances, many of which are listed as other regulatory requirements (lessee advisories) in Chapter Seven (see also Chapter One, Section E and Appendix B). Additional project-specific and site-specific mitigation measures will be required by permitting agencies as appropriate if exploration and development proposals are submitted.

Licensing activities alone are not expected to have any effects, other than initial revenue to the state. Post-licensing activities could affect the terrestrial, freshwater, and marine habitats, and fish and wildlife of the license area. These 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 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 a gas blowout could have effects as well.

If a discovery is made and brought into production, the state of Alaska as a whole, the Bethel Census Area, and especially the local communities could experience the effects of gas development activities. Table 5.1 lists a summary of possible activities and effects of exploration, development, and production.

Table 5.1. Potential activities and effects of gas exploration, development, and production.

Potentially Negative Effect	Potentially Positive Effect
Erosion	Reduced local energy costs
Use conflicts	Employment opportunities
Disturbance to wildlife (including loss of fish and wildlife and habitat loss or change)	Road, dock, and airstrip construction or improvement
Oil spills	Sanitation and utilities improvement or expansion
Alteration of hydrology	State petroleum tax and royalty revenues
Increased noise and traffic	Environmental studies
Water quality changes	
Chemical/pollutant releases	
Siltation	
Impacts to human environment	
Air quality degradation	

Section A of this chapter begins with a technical description of the post-licensing phases of gas activities. Section B focuses on the fiscal effects of these later phases on the state and on the communities within the license area and the expected distribution of fiscal benefits to the state and local areas. Section C addresses other potential impacts on local communities, such as those that affect fishing, infrastructure, and land use. Section D focuses on potential cumulative effects on habitats, fish and wildlife, subsistence activities, and historic and cultural resources of the license area.

A. Post-Licensing Phases

License-related activities proceed in phases. Three phases of industrial activity may follow licensing: exploration, development, and production. 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, and results of the preceding phase. Table 5.2 lists some examples of activities that may occur during these phases.

Table 5.2. Some examples of exploration, development, and production phase activities.

Exploration	Development	Production
Permitting	Gravel pits, pads, and roads	Well workover (rigs)
Water usage	Bridge construction	Gravel pads and roads
Environmental studies	Drilling rigs	Produced water
Seismic tests	Pipelines	Air emissions
Exploratory drilling	Work camps	Pipeline maintenance
Land clearing	Permitting	Work camps
Use of drilling muds and discharges	Monitoring	Trucking
Gravel roadbeds	Wellheads	
Work camp	Reinjection wells	
Increased air traffic	Air emissions	
Temporary gravel pads		
Research and analysis		
Air emissions		

1. Exploration

Exploration activities are designed to gather as much information about the petroleum potential of an area as possible. Exploration activities may include examination of the surface geology; geophysical surveys; researching data from existing wells; 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.

a. Geophysical Exploration

Geophysical companies usually conduct seismic surveys under contract with license holders. Geophysical exploration activities are regulated under 11 AAC 96 and ADNR tailors each permit approval to the specifics of a proposed project. Restrictions on geophysical exploration permits depend on the timing, 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.

Geophysical surveys help reveal what the subsurface may look like. Before proceeding, companies must acquire one or more permits from the state, depending on the timing and extent of the proposed activity. Generally, companies will gather two-dimensional (2-D) and possibly three-dimensional (3-D) seismic data. Two-dimensional seismic programs usually have fewer crewmembers and use less equipment than 3-D programs. Land-based seismic surveys are typically conducted in winter.

To gather seismic data, an energy source is required to generate energy waves that travel into the subsurface. Depending on the difference in densities of the rock layers beneath the surface, these energy waves are reflected back from the various rock layers and are received by vibration-sensitive devices called geophones. Impulses are recorded, processed on high-speed computers, and displayed in the form of a seismic reflection profile.

Geophysical companies use various methods of generating energy, depending on the terrain and conditions. Possible methods might include the use of explosives, Vibroseis equipment, or the dropping of weights. Explosives may be suspended on stakes above the ground (Poulter method) or placed into drill holes and detonated. If buried, drill holes are typically 15 to 25 feet deep with 5 pounds of explosive set at the bottom of the hole. The drill holes are either drilled with track-mounted drills or, if in remote or sensitive areas, slung into position by helicopters. Vibroseis equipment uses a vibrator as the energy source. The vibrating plate is attached to a low-ground-pressure tracked vehicle and creates a sinusoidal vibration of continuously varying frequency, typically lasting seven seconds or longer. Weight dropping can be accomplished with specially designed vehicles or with helicopters. Depending on the location, terrain, and vegetation cover, several energy source techniques might be needed within the license area.

Land-based surveys typically are conducted in winter from mobile camps comprised of survey vehicles, fuel trucks, and modular camp units pulled by bulldozers. Once in the area of operation, these mobile camps are moved every few days to once a week, with fuel trucks making runs to resupply as necessary.

b. Exploration Drilling

When interpretation of the seismic data reveals gas prospects, exploratory drilling is conducted to determine whether a prospect contains commercial quantities of gas. Exploratory drilling generates information for the licensee, which will aid in the decision to proceed to the development phase. Drilling operations include the collection of core samples, well logs, cuttings, and various other forms of information. Cores may be cut at various intervals so that geologists and engineers can

examine the sequences of rock that are being drilled. 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.

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 integrity of the rocks or coal in which it is found, to determine whether to proceed to the development phase.

The drilling process is as follows:

(1) Special steel pipe, conductor casing, is bored into the soil.

(2) The bit rotates on the drill pipe to drill a hole through below-surface rock formations.

(3) Blowout preventers are installed on the surface and are 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.)

(4) Progressively smaller sizes of steel pipe, called casing, are lowered into the hole and cemented in place to keep the hole from caving in, to seal off rock formations, to seal the well bore from groundwater, and to provide a conduit from the bottom of the hole to the drilling rig.

(5) Depending upon the information obtained from exploratory drilling, the well may be put into production, capped, or plugged and abandoned.

Byproducts of drilling activities include muds and cuttings, produced water, and associated wastes. Drilling employs the use of carefully mixed fluids, called muds. Drilling muds are mostly water-based mixtures of clay and other 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 downhole 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 (Table 5.3). Oil- or synthetics-based muds may also be used depending on the well depth, well diameter, and subsurface formations (NRC, 1983; Veil et al., 1996). Hazardous materials are not used in drilling muds. 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 refining. Cuttings are small fragments of rock up to an inch in diameter that are dislodged and carried to the surface by the drilling process in the muds.

According to a 1993 Environmental Protection Agency (EPA) report, the use of water-based muds generates 7,000 to 13,000 barrels of waste per well, and, depending on the depth and diameter of the well, 1,400 to 2,800 of those are cuttings (Veil et al., 1996). Volumes of oil-based muds are generally less than volumes of water-based muds because they are more efficient. Additionally, oil-based muds may be reconditioned, reused, and resold. 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 (Veil et al., 1996). Discharge of untreated oil-based muds into any water column violates federal and state pollution laws.

Table 5.3. Drilling fluid additives.

Type	Common Additive	Use
Weighting material	Barite (barium sulfate ore)	Adds density and counters formation pressure
Viscosifiers	Bentonite clay (mostly sodium montmorillonite)	Removes cuttings, prevents fluid loss, helps seal well bore
Natural and synthetic polymers	Bentonite and drilled clays, corn and potato starch, modified starch, natural gums	Forms mud cake, prevents fluid loss, transports cuttings; hydraulics
Thinners	Plant tannins, polyphosphates, lignitic materials	Reduces temperature effects; reduces viscosity
Ion and pH control	Soda ash, baking soda, sodium hydroxide	Controls corrosion, removes harmful gas (hydrogen sulfide)
Lubricants	Natural and synthetic oil-based compounds	Reduces friction in well bore
Bacteria control agents	Various, depending on ability to meet effluent guidelines	Mitigates fermentation of organics in drill system
Surfactants	Salts, soaps, fatty-acid derivatives	Acts as emulsifier, wetting agent, foamer or defoamer; reduces clay moisture

Source: NRC 1983.

Produced water contains mostly natural substances, such as clay and sand, that are mixed with any oil, water, and gas found in the subterranean strata. Produced waters are usually saline with some level of hydrocarbons. Other production fluids include tank-bottom sludge, brines associated with well workovers, gas dehydration processes, tank wastewater, and other residues that are considered nonhazardous (low toxicity) by the EPA. Like drilling muds, chemicals may be added to produced water to remove harmful bacteria, halt corrosion, break up solids, prevent scale buildup, and break oil/water emulsions (EPA, 1995).

The state discourages the use of permanent reserve pits, and most operators store drilling solids and fluids in tanks until they can be disposed of, generally down the annulus of the well, in accordance with AOGCC regulations. Frozen cuttings may also be temporarily stored on the pad. In most circumstances, the cuttings are transported to a grind-and-inject facility.

If necessary, a flare pit may be constructed to allow for the safe venting of natural gas that may emerge from the well. If the exploratory well reveals a gas reservoir, it is likely that the pad used for the exploratory well will also be used for production testing operations. If an oil reservoir is discovered, all operations must cease, and the operator must immediately contact DO&G, because the exploratory activity is conducted under a gas only exploration license.

2. Development and Production

The development and production phases are interrelated; 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 refinery. 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, 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.

Production operations for natural gas generally consist of the following processes:

(1) Natural gas flows through a high-pressure separator system to remove any liquids (water, condensate, etc.).

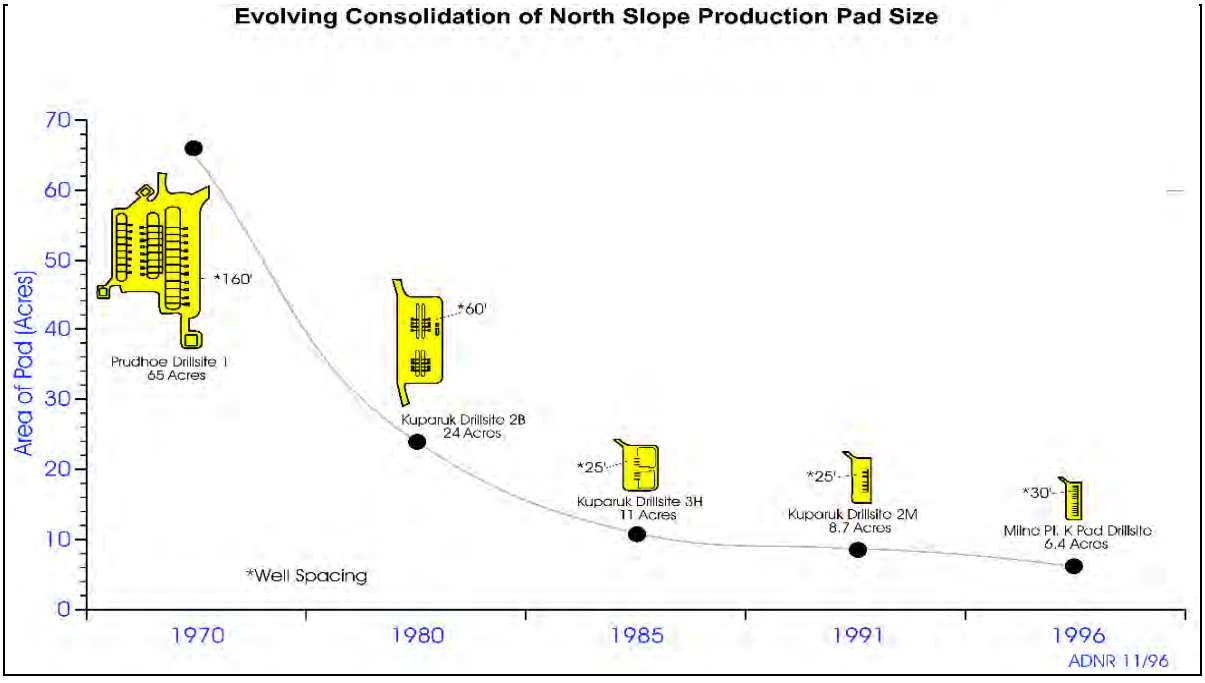
(2) Produced oil, if any, goes through a separator to remove the natural gas from the oil.

(3) The gas is compressed, if necessary, and is dehydrated to lower its water content.

(4) The gas is metered (i.e., the amount of gas produced is measured).

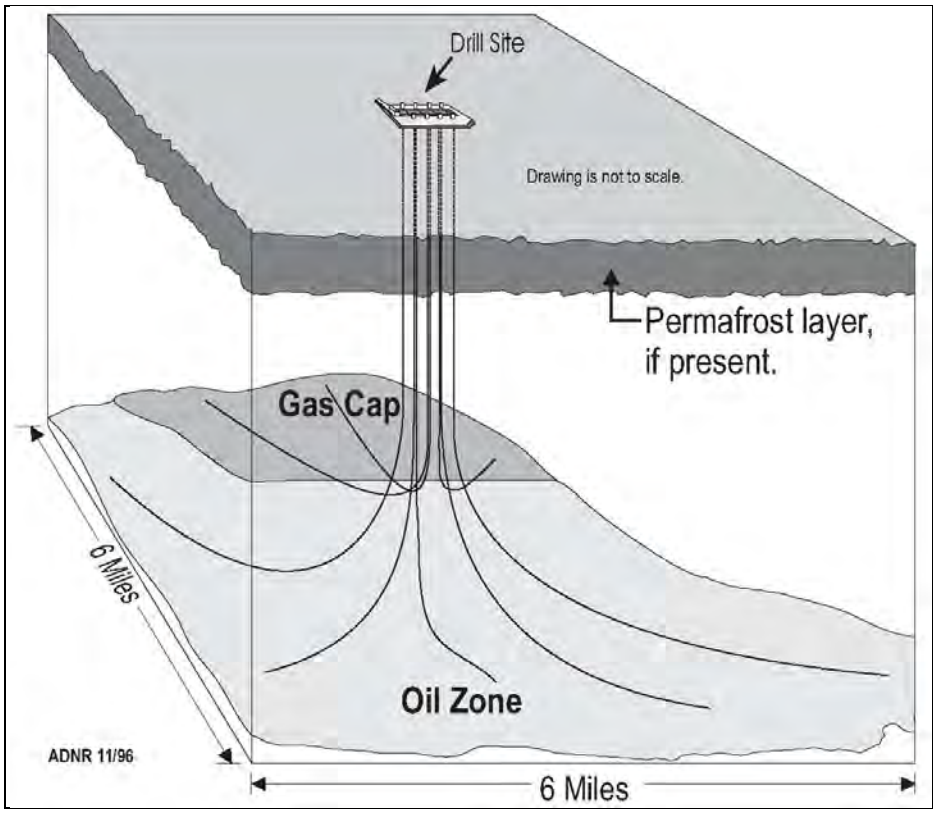
(5) The gas is transported to a facility where it passes through a water precipitator to remove any remaining oil.

Gravel pads are semipermanent structures used for production facilities and can be rehabilitated after field depletion. The development footprint of gravel pads has decreased in recent years as advances in drilling technology have led to smaller, more consolidated pad sizes (Figure 5.1). Figure 5.2 and Figure 5.3 illustrate directional drilling, which results in recovering more product from a larger subsurface area (by increasing the drainage area) than would be possible from a single straight well bore. A single production pad and several directionally drilled wells can develop more than one and possibly several 640-acre sections.



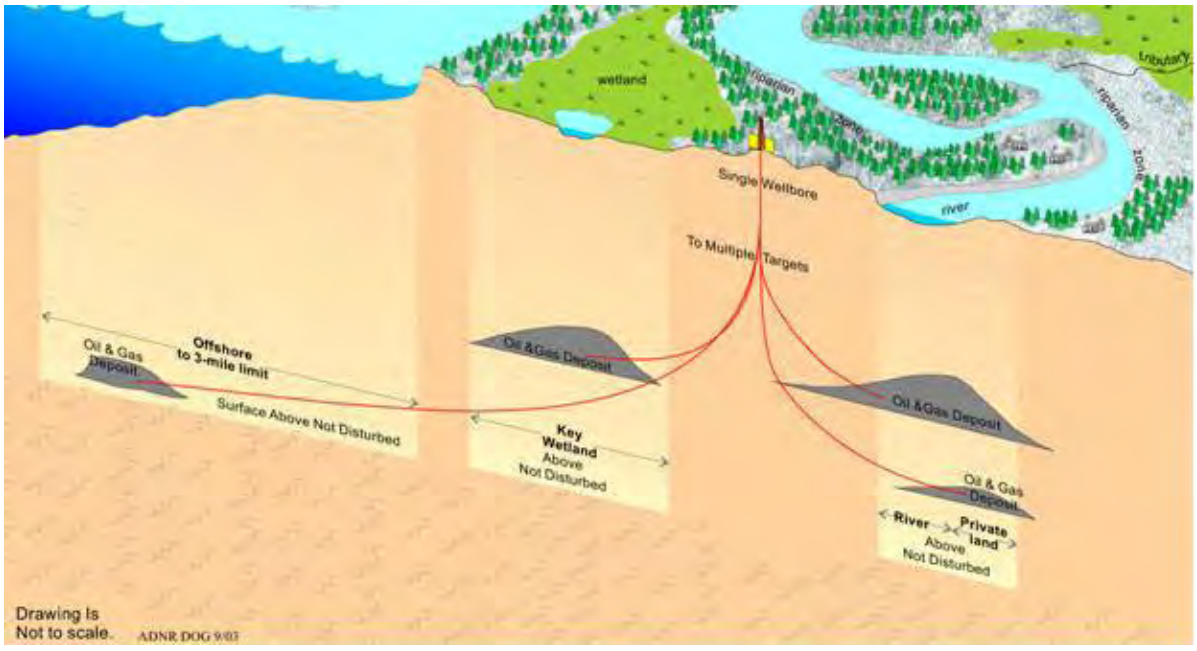
Source: ADNR 1996.

Figure 5.1. Evolving consolidation of North Slope production pad size.



Source: ADNR 1996.

Figure 5.2. Drill site block diagram.



Source: ADNR 2003.

Figure 5.3. Directional drilling applications.

Production of coalbed methane (CBM), the product considered most likely in the Holitna area, is accomplished through both vertically and horizontally drilled wells, much like those described above. 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:

- Coal thickness, lateral continuity, and rank;
- Coal permeability, controlled by amount of fracturing or cleats;
- Depth of burial; and
- Geologic barriers such as impermeable stratigraphic layers or geologic structures (faults or folds), that keep the gas trapped within a coal seam.

At the license issuance phase, it is unknown what a full development scenario would entail. The final project parameters would depend on the surface location, size, depth, and geology of a specific commercial discovery. Scientific understanding of and production experience with CBM are both in the early stages. Much is yet to be learned about what controls the occurrence and recoverability of CBM. The only recent CBM exploration and pilot project in Alaska is that of Evergreen Resources in the Matanuska and Susitna valleys, which was abandoned.

Coalbed methane exploration is occurring in other areas of Alaska. The 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 feet 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).

Implementation of any CBM exploration and development program must meet the requirements of regulatory agencies prior to approval. Permit requirements are evaluated in light of the particular activity proposed, and plans of operation must be approved with appropriate project-specific and site-specific safeguards. Generally, the process for evaluating exploration results is lengthy, involving shallow geophysical surveys, core hole test wells, pilot projects, water disposal plans, and proposed field development.

B. Statewide and Local Fiscal Effects

1. Statewide Fiscal Effects

Alaska's economy depends heavily on revenues related to oil and gas production and the resulting government spending. The following statistics generally illustrate various ways in which the oil and gas industry generates state government revenue.

License Fees. The recipient of the license pays a license fee of $1 per acre. As of January 2006, the state had issued six exploration licenses: Copper River Basin, Nenana Basin, Susitna Basin I, Susitna Basin II, Susitna Basin III, and Bristol Bay Basin I, for a total of 2,546,765 acres. Accordingly, license fees have totaled $2,546,765. When issued, at 26,791 acres, the Holitna Basin license would result in a fee of $26,791.

Rentals. No rentals are due during the term of the exploration license. Once the work commitment has been met, any portion of the licensed area may be converted to gas leases. The term of conversion leases is 5 to 10 years with annual rental fee of $3.00 per acre, or fraction thereof (AS 38.05.134(4)).

Royalties. Royalties represent the state's share of the production as the mineral interest owner. The royalty rate varies from 5 to 60 percent based on the terms of the lease, but most often it is 12.5 percent. 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. Royalties from statewide oil and gas development provided more than $1.4 billion in revenue to the state in FY 2005 (ADOR, 2006). Given the estimated low potential for gas in the Holitna Basin, royalties from this license are expected to have an insignificant effect on overall state revenue.

Severance Taxes. Production taxes must be paid by producers on all taxable oil and gas produced from each lease or property in the state. The taxes are paid on a percentage of gross value basis. Unrestricted oil and gas production taxes were approximately $863.2 million for FY 2005 (ADOR, 2006). Given the estimated low potential for gas in the Holitna Basin, severance taxes from this license are expected to have an insignificant effect on overall state revenue.

Income taxes. All corporations in the state must pay corporate income tax on all taxable income derived from sources within the state. Special provisions apply to apportioning total income worldwide for corporations involved in producing or transporting oil and gas. Most, if not all, producers and transporters of oil and gas in Alaska are corporations. For FY 2004, oil and gas corporation taxes were approximately $524 million (ADOR, 2006). Given the estimated low potential for gas in the Holitna Basin, income taxes from this license are expected to have an insignificant effect on overall state revenue.

Oil and Gas Property Taxes. An annual 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. Property taxes amounted to approximately $42.5 million in FY 2005 (ADOR, 2006). Given the estimated low potential for gas in the Holitna Basin, property taxes from this license are expected to have an insignificant effect on overall state revenue.

Revenue from oil and gas exploration, development, and production comprised approximately 89 percent of the state's general fund unrestricted revenue in FY 2005 and is expected to provide at least 75 percent of forecasted Unrestricted General Purpose Revenue through FY 2009 (ADOR, 2006). Such revenues finance the state's revenue sharing, municipal assistance, education funding, operating budget, and capital budget. State spending supports nearly one out of every three jobs and $3 of every $10 of personal income. Nearly one of every two local government jobs (including school district jobs) in Alaska relies on state funding (ISER, 1990). Oil and gas royalties and revenues also contribute to the Alaska Permanent Fund, which pays significant dividends each year to every qualified state resident. Given the estimated low potential for gas in the Holitna Basin, the contribution of this project to state spending is expected to be insignificant.

2. Local Fiscal Effects

The region's economic structure consists of communities that have seasonal economies, with employment peaking during the summer months. There are no communities within the boundary of the license area; however, the fiscal effects of licensing would extend beyond the license area and affect the regional economy. Communities in the surrounding Holitna region include Aniak, Chuathbaluk, Crooked Creek, Georgetown, Lime Village, McGrath, Napaimute, Red Devil, Sleetmute, Stony River, Takotna, and the greater Bethel Census Area. (See Chapter Four for community profiles.)

a. Employment

The Alaska Department of Labor (ADOL) collects and reports employment data for those jobs that are subject to employment regulation. In the Bethel Census Area, trade, transportation, utilities, education and health services, and local government are the mainstays of the economy (Table 5.4). Commercial fishers, who are excluded from unemployment insurance coverage, are not included in these statistics (ADOL, 2003). Average annual unemployment rates are higher for the Bethel Census Area than for the state as a whole. The 2004 average annual unemployment rate for the Bethel Census Area was 15.3 percent, compared to the statewide average of 7.3 percent. However, average annual unemployment disguises seasonal variations, which tend to be significant for the region (Figure 5.4). The increase in unemployment during the summer months coincides with the fishing season. Persons who hold seasonal jobs in the fishing industry and other jobs during the winter are identified as unemployed during the summer months. Despite the seasonal fluctuation depicted, overall average unemployment is clearly higher in the Bethel Census Area than in the state as a whole.

During 1979-2002, regional per capita personal income was also lower than both state and national per capita averages (Figure 5.5). During 1992-2002, regional per capita income grew at a faster pace than national levels in five of the years, three of which were the most recent years for which data were recorded.

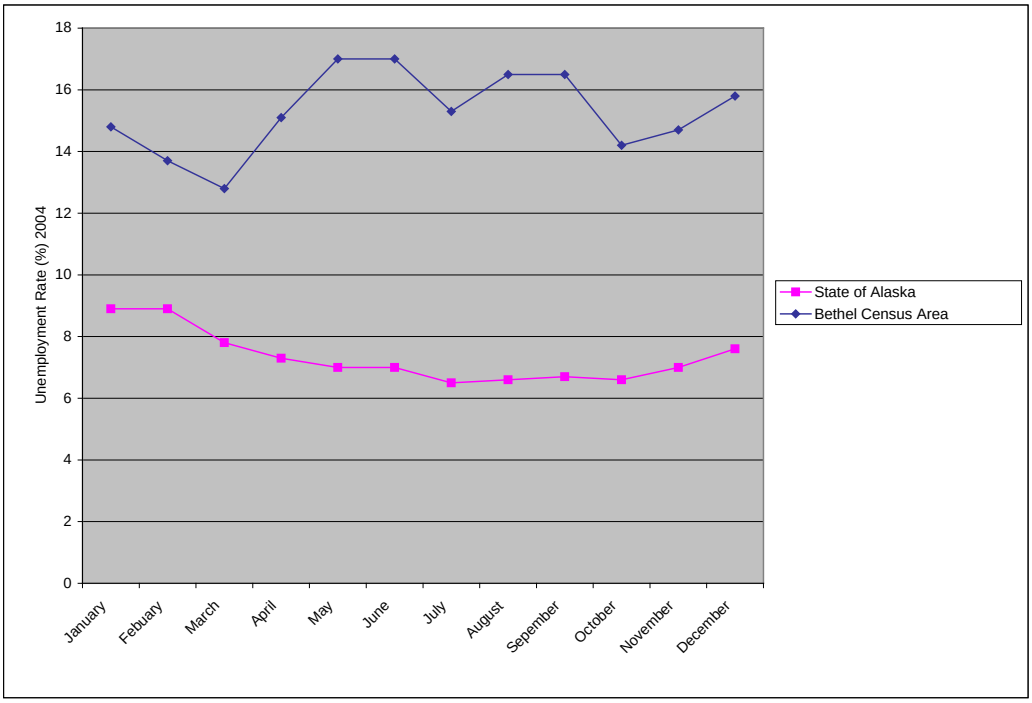
In the 2000 Census, a four-person household with an income below $17,029 was included in poverty statistics. The poverty rate in the Bethel Census Area for 2000 was 20.6 percent compared to 9.4 percent for the entire state. In the Upper Kuskokwim Census Subarea, which includes all communities from Lower Kalskag (26 miles west of Aniak) to Stony River and Lime Village, the poverty rate was 24.2 percent (Windisch-Cole, 2002).

An exploration license may create a small number of new jobs in the local economy for short-term employment during the exploration phase. The long-term employment benefits of a license in the Bethel Census Area and local communities will depend on the subsequent production of commercial quantities of gas, if any. Direct employment in support of a CBM development, including construction, development, operations, maintenance, and support, is estimated to be about 80 people. The number of jobs in related employment, such as in the service, transportation, utilities, and retail sectors of local economies, will depend on project success and size. Local communities could fill some labor needs if projects were proposed, approved, and developed within a reasonable commuting distance. Locally owned and operated companies could also provide services to the licensee or operators and could hire additional staff to meet the increased workload. Local contracts for resources and services, such as gravel and road construction, could stimulate the local economy.

Table 5.4. Average monthly employment in the Bethel census area.

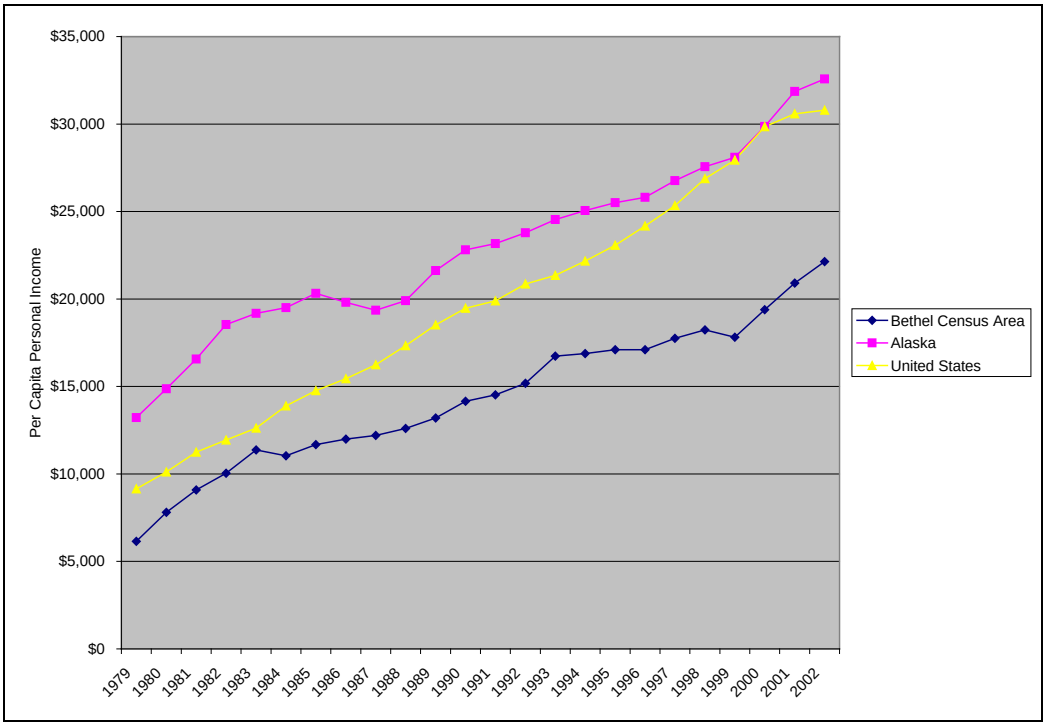
Industry	Average Number of Workers per Month
Federal government	117
State government	335
Local government	2,770
Natural resources and mining	11
Construction	143
Manufacturing	138
Trade, transportation, and utilities	1,067
Information services	95
Financial activities	430
Professional and business services	69
Educational and health services	1,255
Leisure and hospitality	123
Other services	470

Source: ADOL 2003.



Source: ADOL 2004a.

Figure 5.4. Average monthly unemployment rate in the Bethel Census Area and Alaska, 2004.



Source: ADOL 2004b.

Figure 5.5. Per capita personal income, 1979-2002.

Labor supplies in the local communities likely will not be able to meet demands for some technical positions. As a result, these jobs will probably be filled by workers from the service support industry that is active in other regions of the state or from outside Alaska. Licensees and their contractors, however, 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. The licensee is encouraged, in formulating this proposal, to coordinate with employment services offered by the state of Alaska and local communities to train and recruit employees from local communities. Local businesses, such as charter operators, marine parts distributors, heavy equipment operators, welders, plumbers and pipe fitters, carpenters, vendors, food service providers, and air carriers could provide support for gas exploration and development activities. Competition for available labor will probably 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.

b. Cost of Living

Costs of living (represented by food, utilities, fuel, and lumber) in Bethel and Anchorage are compared in Figure 5.5.

Table 5.5. Cost of living comparison for Bethel and Anchorage.

Category	Bethel	Anchorage
Food, per week	$202.08	$118.12
Electricity, per 1,000 kilowatt-hour	$253.71	$115.95
Heating oil, per 55 gallons	$168.25	$108.08
Gasoline, per 55 gallons unleaded	$203.45	$110.18
Lumber, per 2x4x8	$5.57	$3.60
Propane gas, per 100 # refill	$132.25	$47.73

Source: Luick and Bersamin 2004.

Four times each year, the University of Alaska Fairbanks Cooperative Extension Service surveys the cost of food at a home for one week in 18 Alaska communities and Portland, Oregon (Luick and Bersamin, 2004). Although the surveys cannot be used as a proxy for cost of living, they do make the important point that living in a nonurban community in Alaska makes standard goods more expensive to attain. The cost of food is calculated per week for a family of four, including two children ranging in age from 6 to 11 years old. The cost of groceries is generally even higher in the smaller communities in the Holitna Basin because grocery items are distributed through Bethel.

The Alaska Power Cost Equalization (PCE) program provides economic assistance to customers in rural areas of Alaska where, in many instances, the kilowatt-hour charge for electricity can be three to five times higher than in most urban areas of the state because of small market size and expensive fuel oil. The program seeks to equalize the power cost per kilowatt hour statewide.

Under the PCE program of 2004, financial assistance was provided to electric utilities in 181 rural Alaska communities. PCE is designed to pay a portion of legitimate electric power generation costs between a set floor and ceiling, for a basic level of electric service. Both residential and commercial customers, including public schools and community facilities, can share in PCE. Customers are required to pay at least the urban average, but a portion of any additional cost of generation is

covered by PCE. Specific constraints restrict the amount of assistance PCE provides, which is based on current monthly allocation.

PCE serves a total population of approximately 79,000. Several utilities in the Middle Kuskokwim region operate under the PCE program. The Middle Kuskokwim Electric Cooperative, which imported approximately 99,000 gallons of diesel in 2004, provides electricity to the communities of Chuathbaluk, Crooked Creek, Red Devil, Sleetmute, and Stony River (Alaska Energy Authority, 2004). Aniak Light and Power Company, Lime Village Electric Utility, and McGrath Light and Power service the communities of Aniak, Lime Village, and McGrath, respectively. Even with PCE assistance, rural electric costs are two to three times urban energy costs. A local supply of natural gas could help lower energy costs in the vicinity of the license area, depending on the location and size of the discovery.

C. Municipal and Community Effects

1. Commercial Fishing

Harvests for Chinook, chum, sockeye, and coho salmon from the Kuskokwim River saw dramatic declines of more than 90 percent between 1994 and 2002 (ADF&G, 2005b). Variations in salmon runs and commercial fishing regulations account for some of the decline; however, unfavorable market conditions and reduced effort account for most of the decline (SWAMC, 2003). Reductions in the dollar value of salmon over the period are even more dramatic. In 1994, ex-vessel value in the Kuskokwim area commercial fishery for all salmon species was more than $5 million. By 2004, the value of salmon harvests had declined by 72 percent to less than $1.5 million (ADF&G, 2005b). A recent report indicates a rebound, to some extent, in both salmon numbers and prices (ADN, 2005). Commercial fishing is not considered a part of the economy for the communities closest to the license area. However, any effects on fish populations and habitats in the license area have the potential to impact communities downstream on the Kuskokwim River that continue to rely on commercial fishing for their income.

2. Infrastructure

New exploration and development activities require labor and probably also capital-intensive infrastructure. The presence of workers could increase the demand for some public services, like housing or sanitation. Any new exploration and development projects undertaken in areas away from existing infrastructure will probably have to be self-sufficient. If located near existing communities, such activities might place additional burdens on those communities' facilities, however local residents could also benefit from other improved or new facilities and infrastructure such as roads that could ease the time and effort required for travel, and public buildings such as schools and community centers.

Some oil and gas projects require a source of electricity or water. A licensee could provide their own water or electricity or use that of a local community. The suitability of an existing community utility depends on the specific project proposed, its location, and the existing supply and demand for the service. It also depends on the ownership structure of the utility and whether the facility has the capacity to accommodate industrial demand.

3. Land Use

The physical effects of industry activities may include vegetation loss, siltation, sedimentation, quality changes to surface water or groundwater, noise, or increases in human population. The potential cumulative effect of surface impacts on a particular community depends on the location, frequency, and duration of those physical effects, none of which can be predicted accurately prior to the proposal of a specific activity.

Proximity to existing transportation, storage, and refining facilities is a major consideration in petroleum development planning, especially if a discovered field is considered 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, would probably not be readily visible outside the license area.

Communities closest to exploration activities could experience increased use of transportation systems, such as air charter services, airstrips, and roads for moving personnel or construction equipment; however, the license area is remote from existing infrastructure. Large reserves are required to justify the planning, permitting, and construction of a major development site and airstrip off the existing road system. Communities near the license area could benefit from more frequent air service, associated decreases in costs for transporting personal and household goods, and decreased cost for air travel.

Although unlikely, development of the license area could affect human uses of the area and its biological resources if access to hunting, fishing, or trapping areas is restricted or if industry activities occur at the same place and time as these activities. Under DO&G mitigation measures, use of the area by local residents may not be restricted, except when required within the immediate vicinity of drill sites, buildings, and other related facilities. Any area of restricted access must be identified in the plan of operations.

An activity such as the building of permanent roads could allow easier access to property within or near the license area. Additional roads could also improve access for local hunters and subsistence users. Although it is possible that improved access could increase competition for fish and game resources among local users, it is more likely that the improved access will benefit local residents. For example, roads built by oil companies during exploration and development of Cook Inlet area fields have become important for access to subsistence resources for Tyonek and Beluga residents, who travel to subsistence areas primarily by truck (Braund 2007). If roads were constructed across general state lands, they would be open to the public and available for multiple use activities.

If development were to occur, facilities would be consolidated to reduce conflicts with recreational and other uses of the area. A plan of operations would need to include an analysis of road and access issues associated with site development. All aspects of transportation related to the activity and possible effects on existing uses and implementation of mitigation measures would be considered.

D. Cumulative Effects

The potential negative effects of industry's activities include loss of fish and wildlife habitat, environmental degradation, and negative impacts to water and air quality. Potential positive effects include increased understanding of the environment, and improved infrastructure to support and increase access and use of local resources by local residents.

1. Effects on Water Quality

Water quality in the license area could be affected if discharges from exploration, development, or production activities were handled improperly. However, in the circumpolar Arctic, 80-90 percent of petroleum hydrocarbons entering the environment originate from natural seeps (Huntington 2007). Excluding oil spills, activities related to oil and gas exploration, development, and production are minor contributors of petroleum hydrocarbons to the environment (Huntington 2007).

The federal Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) to ensure that state and federal clean water quality standards are maintained by requiring a permit to discharge wastes into the nation's waters. NPDES permits limit the type and amount of pollutants that can be discharged, and include monitoring and reporting requirements, to ensure that

discharges are not harmful to water quality and human health. NPDES covers a broad range of pollutants, which are defined as "any type of industrial, municipal, and agricultural waste discharged into water" (EPA 2008). Examples of gas industry effluents regulated by the 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.

Water quality could also be affected by winter seismic surveys through thermokarst erosion and snow compaction (BLM, 2004). Thermokarst results from degradation of the insulating vegetative layer, which allows the underlying permafrost to melt; this could result in soil erosion that could impact adjacent surface waters. Other potential impacts include snow removal and compaction, which increase the depth of ice on surface waters and, in turn, could increase the salinity of the unfrozen water in lakes and streams. However, mitigation measures require that tracked vehicles be 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 breakup. Alteration of the banks of a watercourse is prohibited. Adherence to these conditions avoids or minimizes post-survey increases in erosion, turbidity, and suspended solids in a drainage area.

Water withdrawals from lakes and ponds is required for the construction of 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, thereby affecting dissolved oxygen levels (BLM, 2004). The construction of ice roads and pads could impact water quality by adding slightly saline water during spring melt to shallow lakes and by diverting stream or lake flow, which could cause bank erosion and sedimentation.

Gravel mining for the construction of permanent roads and pads could impact water quality both during the gravel mining operation and after construction through thermokarst and upslope impoundment. However, gravel mining will be permitted within the active floodplain only if DMLW and ADF&G determine that there are no feasible or prudent alternatives and that a floodplain mine site would enhance fish and/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 could darken vegetation, increasing the heat absorption of the ground surface, melting permafrost, and causing thermokarst. Thermokarst could impact water quality by altering water chemistry or by eroding mineral soil layers under the peat mat. Dust and thermokarst could increase the turbidity of surface waters adjacent to gravel pads and roads (BLM, 2004).

Water quality could be affected if spills occurred during post-licensing activity. The extent and duration of the effects would depend on the type of product, the location of the spill, volume spilled, season, duration of the spill or leak, and the effectiveness of clean-up 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 normal operations, such as refueling, or from corrosion of lines. However, mitigation measures require that for off-road activity, fuel and hazardous substances must have secondary containment apparatus. A secondary containment or surface liner is required under all container or vehicle fuel tank inlet and outlet points. Appropriate spill response equipment is required during any transfer or handling of fuel or hazardous substances. In addition, vehicle refueling is prohibited within annual floodplains (ADGC, 1995).

Although considered highly unlikely, there is the potential for a well blowout during exploration and production activities. As explained in Appendix E, CBM wells include installation of blowout preventers during the drilling of the well. However, if a blowout were to occur, it could have effects on water quality that are similar to spills. Fires associated with blowouts, either unintentional or as a cleanup technique, could produce additional air contaminants that could affect surface water quality. These emissions include NO_x, CO, SO_2, and particulate matter (BLM, 2004).

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. The AOGCC requires proper and safe handling and disposal of drilling wastes. The AOGCC oversees the underground operation of the Alaska oil and gas industry on private and public lands and waters. Additionally, the AOGCC administers the Underground Injection Control (UIC) program for oil and gas wells, acts to prevent waste of oil and gas resources and ensure maximum recovery, and protects subsurface property rights.

AOGCC requires a permit prior to injecting any drilling waste or 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 (such as 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 is then reinjected either into an approved disposal well or into the hydrocarbon-bearing formation to maintain pressure and enhance recovery. Disposal of cuttings is either through on-site grinding and injecting or through transport to an approved disposal site. Wastewater, including sanitary and domestic gray water, is also treated to meet effluent guidelines before discharge.

Surface disposal of produced water is not allowed unless ADEC determines the discharge will meet state water quality standards. An NPDES permit is also 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 gray water, is also treated to meet effluent guidelines before discharge. Unless authorized by NPDES and state permits, disposal of wastewater into freshwater bodies is prohibited. Plan of operations approvals may include monitoring requirements to mitigate potential impacts on water quality and quantity. The monitoring requirements are tailored to the specific situation and potential impacts.

Although gas activities subsequent to licensing could potentially have cumulative effects on water quality, 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 protect water quality address siting of facilities and pipelines, gravel mining, protection of fish bearing water bodies, and handling and disposal of hazardous wastes including drilling muds and cuttings. A complete list of mitigation measures and licensee advisories is found in Chapter Seven.

2. Effects on Air Quality

Gas exploration, development, and production activities may produce emissions that have the potential to affect air quality. Equipment that could produce pollutants includes boilers, diesel engines, drilling equipment, flares, glycol dehydrators, natural gas engines and turbines, and fugitive emissions which are leaks from sealed surfaces associated with process equipment (MMS 2004a, b). Loading operations may also result in emissions caused when vapor space in the receiving cargo hold is displaced by the liquid product. Emissions may include 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_20) (MMS 2004b).

Oil and natural gas industries emitted an estimated 3.0 million metric tons of greenhouse gases throughout Alaska in 2005, which was about 6 percent of the total greenhouse gas emissions in Alaska (Roe et al. 2007). This is a decrease from 1990 and 2000, and continued decreases are expected through 2020. There are significant uncertainties with these estimates. These estimates are for fugitive emissions, which are released during the production, processing, transmission, and distribution of oil and gas. Fugitive emissions include methane and carbon dioxide released from leakage and venting at oil and gas fields, processing facilities, and pipelines. Estimates of emissions resulting from fuel combustion are only available for residential, commercial, and all industries combined, and are not available for the oil and gas industry separately (Roe et al. 2007).

At the licensing phase, the amount of pollutants that might be produced in subsequent phases is unknown but all industrial emissions must comply with the Clean Air Act and state air quality standards. The ADEC and EPA programs and requirements described in Chapter One are expected to provide adequate protections of air quality during phases subsequent to licensing.

3. Effects on Fish and Wildlife Habitat and Populations and Their Uses

a. Terrestrial Habitat

Various activities associated with gas exploration and development in the license area, including seismic operations, exploratory drilling, ice-snow road and pad construction, gravel road and pad construction, and pipeline construction, have the potential to effect terrestrial habitat through the disturbance of soils and vegetation during clearing and grubbing activities. Some clearing activities may be necessary for gas exploration, particularly in parts of the license area dominated by woody vegetation. Clearing involves chipping vegetation or felling and removing any trees and undergrowth from an area; grubbing involves removal of roots and other vegetation within the same area. Any clearing or grubbing activities related to gas exploration and development require prior approval from the director of DO&G. Proper disposal of slash during clearing and grubbing activities is necessary to reduce the risks of fire, infestation, and disease.

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 could detrimentally affect entire watersheds and associated organisms. Although efforts are made to avoid wetlands during exploration and development, it could become necessary to develop certain wetlands. The discharge of dredge or fill material affecting wetlands requires a Section 404 permit from the U.S. Army Corps of Engineers and, depending on the activity, could require additional action from the EPA and the state.

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 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 snowpack reduce the impact to vegetation; however, winter seismic trails do have the potential to compress microtopography, resulting in an overall wetter environment (BEST, 2003). Such a change in hydrology could impact resident species, inducing a change to more water-tolerant species.

Modern seismic surveys also use technology such as global positioning system (GPS) instruments 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. Many areas are accessed by helicopter, which minimizes the disturbance of vegetation and sensitive environments.

Ice-snow roads are commonly constructed for winter exploration activities to minimize environmental impacts. However, construction of well collars and ice-snow roads and pads during the exploration phase has the potential to impact vegetation. Upland vegetation, including shrubs, forbs, and tussocks, is most susceptible to damage from ice-snow roads, whereas wetlands show few or no signs of damage (Guyer, 2003). Holes dug into the ground for the construction of well collars could result in the disturbance of a small area of vegetation; thermokarsting in the immediate vicinity of the well collar, if present, could also lead to an accumulation of water and potential shift to more water-tolerant plant species.

Activities during the development phase that have the potential to impact vegetation include constructing gravel pads, gravel roads, and pipelines. Also, impoundment of water and gravel extraction could cause direct loss of acreage, and construction of gravel roads and pads, a direct loss of habitat. Additionally, dust blown from gravel roads and pads could reduce photosynthesis and plant growth and lead to an increase in downstream siltation and sedimentation, which can affect plant viability. Water impoundment along gravel roads and pads could create inundation upgradient and drier habitat downgradient. In addition to changes in species composition related to water impoundment and drainage, the construction of facilities could allow the revegetation of disturbance-colonizing species such as fireweed (*Epilobium angustifolium*).

Gravel used in the development phase for gas production could be mined from existing sites or could require the development of new sites. Stockpiling overburden and excavating gravel could disturb vegetation.

If any part of a pipeline were to be elevated, a small amount of vegetation could be permanently displaced by the installation of vertical support members, and vegetation could be cleared within the right-of-way. Adjacent vegetation could 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, initially a larger area of vegetation could be disturbed because of the trenching requirements. Trenched areas could be revegetated after installation of the pipeline.

All revegetation efforts would use local native vegetation to avoid impacts from introduced species. The right-of-way would be maintained to allow access for maintenance, keeping the vegetation in an early successional stage.

As stated previously, a very remote possibility exists that oil could be encountered in the course of exploring for gas in the Holitna Basin. If oil were encountered, the licensee would be required to cease operations and contact the state. Although the likelihood is extremely small, incidental oil spills are possible. The effects of an oil spill on vegetation depend on the quantity spilled, time of year, impacted species, and terrain. Spilled oil will migrate both horizontally and vertically, depending on the volume spilled, type of cover (plant or snow), slope, presence of cracks or troughs, moisture content of soil, temperature, wind direction and velocity, thickness of the oil, discharge point, and ability of the ground to absorb the oil (Linkins et al., 1984).

The spread of oil is less when it is thicker, cooler, or exposed to chemical weathering. If the ground temperature is lower than the pour point of the oil, it will pool and be easier to contain. Dry soils

have greater porosity and potential for vertical movement (Linkins et al., 1984, citing Everett, 1978). If oil penetrates the soil layers and remains in the plant root zone, longer-term effects such as increased mortality or reduced regeneration could occur in subsequent summers. Plant mortality in nonwetland areas also is anticipated as an outcome of certain spill response techniques, such is in situ burning. In situ burning in wetland areas can be accomplished and still preserve the root viability of many plant species allowing regrowth during the next growing season.

Drill cuttings, which are rock fragments generated during drilling, are produced during the drilling of the borehole. Typically, the muds (drilling fluid used to circulate the cuttings out of the hole) used to drill CBM wells (if drilling muds are used at all) do not contain any hazardous materials. During the drilling operations, the cuttings are separated from the drilling muds and the muds reused. On-pad temporary cuttings storage would be allowed, as necessary, to facilitate annular injection and/or backhaul operations. Surface discharge of drilling muds and cuttings into lakes, streams, rivers, and high value wetlands is prohibited.

Muds and cuttings usually are disposed of on-site because neither contain hydrocarbons or other hazardous substances. The state discourages permanent reserve pits; the preferred method for disposal of muds and cuttings is by underground injection. Injection of nonhazardous wastes generated during development is regulated and permitted by AOGCC through its UIC program for oil and gas wells. Surface discharge of drilling muds and cuttings into reserve pits would be allowed only if the director, in consultation with ADEC, determines that alternative disposal methods are not feasible and prudent. If use of a reserve pit were proposed, the operator must demonstrate the advantages of a reserve pit over other disposal methods, and describe methods to be employed to reduce the disposed volume. The operator must also fill and cap the pit with gravel when drilling operations are completed.

Immediately after removal of the drilling rig, all debris and other waste material not contained within trash barrels is required to be cleaned up and removed from the well location. No potentially adverse materials or substances is allowed to remain on the drill site.

Although gas activities subsequent to licensing could potentially have cumulative effects on terrestrial habitats, 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 protect terrestrial habitats address siting of facilities and pipelines, disturbance of vegetation, gravel mining, and handling and disposal of hazardous wastes including drilling muds and cuttings. A complete list of mitigation measures and licensee advisories is found in Chapter Seven.

b. Effects on Fish

During the exploration phase, seismic activities are typically conducted during the winter months or with helicopters to minimize effects on the environment. Seismic operations using high explosives could cause direct injury to fish resources in lakes and streams (Fink, 1996). Pressure waves from high explosives can injure fish near the explosion, but the impulses would dissipate to a nonlethal level within a short distance (less than 328 feet) (MMS, 1996). Overpressures of 30 to 40 pounds per square inch (psi) will kill fish with swim bladders, and 3 to 4 psi can kill juvenile salmonids. Shockwaves from explosions can also shock and jar fish eggs at sensitive stages of development. These types of impacts are mitigated by restricting the use of explosives in the vicinity of fish-bearing lakes and streams.

The use of tracked vehicles during seismic exploration could physically damage overwintering habitat. Tracked vehicles that cross fish-bearing lakes or streams could cause compaction or removal of snow layers, which would increase the depth of ice over these surface waters, and in turn reduce

the quantity of available water for overwintering fish and also increase the salinity of the unfrozen water (BLM, 2004).

Water withdrawals from lakes and ponds could 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 could also impede the ability of fish to reach overwintering habitat.

Gravel mining could be required during the exploration, development, and production phases for road and pad construction. Gravel removal from fish-bearing streams to support gas development activities could adversely impact the habitat in these streams and the fish they support. Gravel removal could increase sediment loads, change the course of the streambed, cause instability upstream, destroy spawning habitat, and create obstacles to fish migration.

Construction and associated clearing activities for roads, pads, and pipelines could impact fish habitat and passage between overwintering, spawning, and feeding areas. The potential for damage to stream banks exists in areas where heavy equipment used for construction must cross streams. During the open water period, stream bank degradation creates erosion problems, which impact downstream fish habitat through siltation of the streambeds. Improper placement and construction of roads, pads, and pipelines could alter water flow, which could impede fish passage. Common obstructions to fish passage include improperly sized culverts or low water crossings and ice bridges present during spring breakup (BLM, 2004).

Operational spills could result from small, chronic leaks from equipment or facilities. The effects of oil spills on fish would depend on many factors including the time of year, size of the spill, water body affected, length of exposure, and the stage of development of the fish present (BLM, 2004). Potential adverse effects from an oil spill 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. Sublethal effects could also reduce fitness and affect the ability to endure environmental stress. Effects of oil spills during the winter are expected to be negligible, but could be major during the open water season, depending on the site-specific conditions.

If a natural gas or oil blowout occurred, indirect effects from pollutant fallout, including NO_x, CO, SO_2 and particulate matter, could affect fish (BLM, 2004). 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 could be toxic to fish. Aluminum released by acids leaching through soils is directly toxic to fish (EPA, 2005b).

Although gas activities subsequent to licensing could potentially have cumulative effects on fish, 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 protect fish address siting of facilities and pipelines, gravel mining, use of explosives in fish bearing waters, snow and ice cover overlying fish bearing waters, removal of water from fish bearing waters, and handling and disposal of hazardous wastes including drilling muds and cuttings. A complete list of mitigation measures and licensee advisories is found in Chapter Seven.

c. Effects on Birds

The Holitna Basin provides habitat for several species of birds (see Chapter Three). Effects of industrial activities on birds depend on the species, the time of the year, and the age or reproductive

state of the species, as well as the disturbance type, intensity, and duration. Cumulative adverse effects on birds from gas activities could result from direct habitat loss, barriers to movement, collision with structures, noise and disturbance during nesting and brood rearing, and pollution of the terrestrial and aquatic environments.

During the exploration phase of gas development, habitat loss could occur as a result of seismic activities and the construction of ice-snow roads and pads. Upland vegetation, including shrubs, forbs, and tussocks, is most susceptible to damage from ice-snow roads, whereas wetlands show few or no signs of damage (Guyer, 2003). However, on-the-ground seismic exploration performed over tundra during the winter months has the potential to modify the water regime, forcing a shift in vegetative species composition in areas that served as trails. This shift in species composition and damage to upland vegetation could result in habitat loss for species of birds that prefer slightly drier or shrubbier environments, such as many species of passerines. Some species could experience beneficial impacts. For example, impoundments from roads changing drainage patterns could create additional habitat for waterfowl (ducks or geese).

Clearing vegetation or filling wetlands for the construction of gravel pads, roads, facilities, and pipelines also could result in the direct loss of bird habitat. The construction of permanent facilities could damage habitat indirectly from surface water impoundment, thermokarsting, and dust blowing off gravel roads and pads. Some habitat loss could be compensated through the construction of new buildings and structures; mostly passerines, but also ravens and some species of raptors, are known to use manmade structures for nesting. The Migratory Bird Treaty Act protects these birds from disturbance after nesting has begun, even if they are nesting on manmade structures.

Activities involved with the exploration, development, and production of natural gas have the potential to generate noise and other disturbances that could impact birds. Birds are particularly susceptible to disturbance when attending a nest, accompanying fledging young, or in a flightless molt condition. Disturbance could cause birds to abandon local nesting, feeding, or molting areas; to expend energy stores necessary for migration or winter survival; and to experience increased predation from animals attracted to the facilities.

Repeated low-level aircraft overflights could cause some nesting birds to flush and expose eggs to chilling or predation. Altitude restrictions on aircraft could help to minimize this impact. Aircraft overflights also could cause disturbance of concentrations of feeding, molting, or staging waterfowl in lakes and other wetlands, which might reduce the ability of these birds to acquire the energy necessary for successful migration. If frequent, such disturbances could affect the bird migration and mortality.

Bird mortality also could result from collisions with vehicular traffic, buildings, elevated pipelines, and overhead power lines. However, ADNR anticipates that bird mortality from such collisions would be minimal and have little impact on bird populations.

Prevention of and countermeasures in response to any oil spills 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. Direct oil contact is often fatal and oil spills in aquatic environments can result in substantial mortality to birds. Oiling of birds causes death from hypothermia, shock, or drowning.

The direct effect of oil 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, could 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. Even small quantities of oil deposited on eggs from the feathers of the adults also can have an adverse impact on hatching. The birds most susceptible to oiling are those that are gregarious, spend most of their time on the water, and dive rather than fly up when disturbed (NRC, 1985).

Although gas activities subsequent to licensing could potentially have cumulative effects on birds, 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 protect birds address siting of facilities and pipelines, protection of important waterfowl habitat, and handling and disposal of hazardous wastes including drilling muds and cuttings. A complete list of mitigation measures and licensee advisories is found in Chapter Seven.

d. Effects on Terrestrial Wildlife

i. Caribou and Moose

Caribou and moose are discussed together, as the possible impacts and mitigation measures may be similar for the two species. Exploration, development, and production phases may require the construction and continued use of support facilities such as roads, production pads, pipelines, and other facilities. Clearing of land for these uses could affect caribou and moose. For example, forest habitats may be decreased when seismic lines are cleared, and this habitat loss may be 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). In one study, 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, which are seldom used now, 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).

In addition to clearing, development and production phases 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. On the other hand, activity on seismic lines may be limited to the duration of the seismic survey, although other recreational uses may continue, including use of snow machines, all-terrain vehicles, and hunting. 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).

Some limited information is available concerning other effects of support facilities. For example, in one study, caribou used habitat near roads less than habitat farther away, ranging from 0 percent of expected use in closed coniferous wetlands in late winter to about 34 percent 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 percent for others (Dyer et al. 2001). Cumulative effect of avoidance of all industrial development was a potential loss of 48 percent 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).

ii. Bears

Both black and brown bears could potentially be affected by gas activities in phases subsequent to licensing. 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. One study of the 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). Wintertime seismic activity may disturb denning brown bears up to 1.15 miles from the activity, according to a study of movement of radio-collared bears in their dens (Reynolds et al., 1986). Also, bear cubs are born during the winter, and disturbance of dens during this critical time could impact the cubs. Both black and brown bears are attracted to food and garbage associated with human activity and could become conditioned to unnatural food sources (ADF&G, 2004d). This conditioning could pose a safety threat and hence the potential need to destroy problem animals. With increased development, wildlife managers may also be concerned about 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).

iii. Wolves

Wolves are present in GMU 19A; 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.

The effects of direct habitat loss on wolves would likely be negligible. The abundance of wolves and other predators in the area ultimately is determined by the availability of prey and by game management efforts. The ability of adults to provide food is the key determinant in survival of the young. A reduction in prey species could reduce predator populations (USFWS, 1987). A wolf control program in effect in GMU 19A has targeted an 80 percent decrease in the wolf population by 2009 in order to decrease predation on moose (Alaska Board of Game, 2004).

Seismic activities and aircraft overflights may be sources of potential disturbance to wolves. Helicopters generally evoke a stronger response from wolves and other predators than fixed-wing aircraft. Vehicles on roads connecting well sites and supply areas may also be a potential source of disturbance. Impacts of seismic exploration and drilling on these species are unknown, although these activities could result in some temporary disturbance of nearby wolves (USFWS, 1986).

iv. Furbearers and Other Small Mammals

Several species of furbearers are found in the area, including red fox, river otter, marten, wolverine, lynx, muskrat, snowshoe hare, and beaver (ADNR and ADF&G, 1987; Boudreau, 2004). The effects of direct habitat loss on these species would probably be negligible. The abundance of red fox and other predators in the area ultimately is determined by the availability of prey and by game management efforts, as the ability of adults to provide food is the key determinant in survival of the young. Reduction in prey species could reduce predator populations (USFWS, 1987).

Most of these species are unlikely to be affected by development within the area. Primary sources of disturbance are seismic activities and aircraft overflights. Vehicles on roads connecting well sites and supply areas could also be a source of disturbance. Impacts of seismic exploration and drilling on these species are unknown, although these activities could result in some temporary disturbance of nearby furbearers and other small mammals (USFWS, 1986). Attraction of animals to garbage and other waste could also result in adverse impacts on individuals. Fox are particularly adept at obtaining human food sources.

v. Mitigation Measures

Although gas activities subsequent to licensing could potentially have cumulative effects on terrestrial wildlife, 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 protect terrestrial wildlife address siting of facilities and pipelines, important moose and caribou calving and overwintering areas, human-bear interaction plans, and handling and disposal of hazardous wastes including drilling muds and cuttings. A complete list of mitigation measures and licensee advisories is found in Chapter Seven.

4. Effects on Subsistence Uses

Many factors affect subsistence 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 subsistence users, 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 subsistence activities, which could also increase subsistence opportunities and hunting success.

As discussed in Chapter Four, villages in the Holitna Basin area use parts of the license area for subsistence uses such as moose, caribou, and migratory bird hunting; trapping; and fishing for whitefish, burbot, northern pike, and other resident fish species. There are no commercial harvests of any of these resources in the Holitna Basin, although salmon populations in the Holitna and Hoholitna rivers contribute to the Kuskokwim River commercial fishery.

Although gas activities subsequent to licensing could potentially have cumulative effects on subsistence, 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 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 indirectly by protecting the fish and wildlife populations and habitats on which subsistence harvests rely. A complete list of mitigation measures and licensee advisories is found in Chapter Seven.

5. Effects on Cultural and Historic Resources

Cultural and historic resources are those sites and artifacts having significance to the culture of the people within the license area. The ADNR, Office of History and Archaeology, through the Alaska

Heritage Resources Survey (AHRS), maintains an inventory of cultural and historic resources within the state, including objects, structures, buildings, sites, districts, and travel ways within the region. Historical and cultural resources commonly include sites such as isolated Native villages and gravesites, cabins, fish camps, mines and mining-related sites, and transportation-related sites.

The ADNR, Office of History and Archaeology, has researched the available sources and has found no known historic or prehistoric sites in the license area. However, parts of the license area may have been surveyed but included sites not reported. As archaeological surveys in remote parts of Alaska are often conducted along river corridors, many sites along the Holitna, Hoholitna, and Kuskokwim rivers, outside the license area, have been reported. If a potentially historic site is discovered during project activities, an archaeologist should immediately be brought on-site to confirm the presence and subsequent preservation of any archaeological resources. The archaeologist would complete the reporting requirements for the SHPO for the site's inclusion in the AHRS, including the site name, description, location, and pertinent dates.

State policy on these resources is reflected in AS 41.35.010: "It is the policy of the state to preserve and protect the historic, prehistoric, and archaeological resources of Alaska from loss, desecration, and destruction ...." Existing statutes, which apply to both known sites and newly discovered sites, include the following:

- AS 41.35.200(a) prohibits a person from unlawfully appropriating, excavating, removing, injuring, or destroying any historic, prehistoric, or archaeological resources of the state. Historic, prehistoric, or archaeological resources include deposits, structures, ruins, sites, buildings, graves, artifacts, fossils, or other objects of antiquity that 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 41.35.010 through AS 41.35.240 prohibit the unlawful destruction, mutilation, defacement, injury to, removal of, or excavation of a grave site, tomb, monument, gravestone, or other structure or object at a grave site, even if the grave site appears to be abandoned, lost, or neglected.
- AS 41.35.210 and AS 41.35.215 specify that violators of AS 41.35.230(2) and of AS 41.35.010 through AS 41.35.240 are subject to criminal (misdemeanor) penalties and civil penalties (fines up to $100,000 per violation).

Potential impacts on cultural resources could occur during the exploration, development, or production phases. Prehistoric and historic archaeological resources could be affected by any ground-disturbing activities, including those associated with installation and operation of facilities, such as drill pads, roads, airstrips, pipelines, and processing facilities. Damage to archaeological sites could include breakage of cultural objects, damage to vegetation and the soil thermal regime leading to erosion and deterioration of sites, and shifting or mixing of components at sites resulting in loss of association between objects. Work crews at archaeological or historic sites also could damage or destroy sites by collecting artifacts (USFWS, 1986).

Cumulative effects on archaeological sites from normal gas exploration, development, and production activities is expected to be expected to be low. In the event that an increased amount of ground-disturbing activity takes place, state and federal laws and regulations are expected to mitigate effects to archaeological resources.

Disturbance to historical and archaeological sites might occur as a result of activity associated with accidents, such as a gas well blowout or explosion. Archaeological resources in the immediate vicinity of the blowout might be destroyed, and cleanup activities could result in disturbance by workers near the accident site.

Although gas activities subsequent to licensing could potentially have cumulative effects on cultural and historic resources, 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 protect cultural and historic resources address inventories of prehistoric, historic, and archaeological sites, reporting and preservation of sites, and training. A complete list of mitigation measures and licensee advisories is found in Chapter Seven.

Chapter Six: Specific Issues Related to Geophysical Hazards and Gas Transportation

Table of Contents

Page

A. Geophysical Hazards 6-1
1. Earthquakes and Faults 6-1
2. Volcanoes 6-1
3. Flood Hazards 6-2
4. Permafrost 6-4
5. Summary 6-5
B. Transportation 6-5
1. Pipelines and Their Components 6-5
a. Pipe 6-5
b. Compressor Stations 6-5
c. Metering Stations 6-6
d. Valves 6-6
e. Buried Pipelines 6-6
C. Gas Release and Oil Spill Risk, Prevention, and Response 6-6
1. Gas Release and Oil Spill Risk 6-6
2. Prevention and Response 6-6

List of Figures

Figure **Page**

Figure 6.1. Volcano and historic earthquake epicenter locations. 6-3

Chapter Six: Specific Issues Related to Geophysical Hazards and Gas Transportation

A. Geophysical Hazards

Natural conditions and processes would impose some constraints on exploration, production, and transportation activities associated with possible gas development, but proper site planning, design, and construction practices could accommodate the potential natural hazards present in the license area. Primary hazards within the region include (1) earthquakes associated with the Farewell Fault; (2) volcanoes; and 3) localized permafrost, floods, and stream icings. Following is a brief summary of available information related to these hazards.

1. Earthquakes and Faults

Seismic activity in the Holitna Basin is associated with the Farewell Fault zone, which is a western continuation of the larger Denali Fault system. The basin is associated with right-lateral strike-slip motion on the fault (LePain et al., 2003). The majority of seismic activity in Alaska is associated with the North American and Pacific Plates boundary in Southcentral Alaska and the Aleutian Chain, which is located more than 100 miles to the south and east of the license area (AEIC, 2004). Known faults in the license area are shown in Figure 2.3.

Figure 6.1 shows the Farewell Fault and earthquake epicenters of magnitude greater than 5.0. Approximately 10 miles north of the license area, an earthquake of magnitude 5.8 was recorded in 1971; two additional earthquakes of magnitude 6.1 and 6.9 were located 60 miles to the west of the license area in 1990 and 1993, respectively (AEIC, 2004). Earthquakes with magnitudes greater than 5.5 are considered potentially damaging. Potential physical effects resulting from earthquakes include foundation settlement, foundation failure, structural failure, lurching, soil liquefaction, landslides, compaction and seiches, which can include not only sloshing of water in lakes but also the contents of storage tanks (Stevens and Craw, 2004). The International Building Code publishes provisions for building structures based on the United States Geological Society (USGS) National Earthquake Hazard Reduction Program maps. In the license area, all structures must be designed and built to meet or exceed the Uniform Building Code specifications for seismic zone 2B (moderate earthquake risk). Design, construction, and operation of facilities must mitigate the possible effects described above, with the goal of preventing loss of human life and significant damage during earthquakes

2. Volcanoes

The license area is located within 200 miles of several volcanoes of the Cook Inlet region including Augustine, Iliamna, Redoubt, and Hayes volcanoes and Mount Spurr. Augustine erupted in 1986 and 2006 (Waythomas and Waitt, 1998; AVO, 2006), disrupting air traffic and resulting in ash fall over several Kenai Peninsula communities. Evidence of volcanic activity at Iliamna includes gas and steam rising from volcanic fumaroles. Seismic activity recorded beneath Iliamna in 1996 may indicate the potential for future activity (Waythomas and Miller, 1999). Redoubt had significant explosive events from December 1989 to April 1990. Several eruptions throughout that period of activity deposited ash on the Kenai Peninsula that affected the populace, commerce, oil production, and transportation. Ash affected air traffic as far away as Texas during this period of activity (Waythomas et al., 1998). Three eruptive events from Mount Spurr in 1992 also caused significant

ash fall and delays at the Anchorage airport (Waythomas and Nye, 2002). In July 2005, Mount Spurr also showed activity (AVO, 2005). No records of historical eruptive activity on Hayes exist and no signs of unrest were observed during visits in 1999 and 2000 (Waythomas and Miller, 2002).

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 ash fall: Explosive eruptions blast volcanic ash (finely ground volcanic rock) into the atmosphere and stratosphere, and it then drifts downwind and falls to the ground. Scores of such events have occurred from Cook Inlet and Alaska Peninsula volcanoes in the last century. 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 they ingest ash past the air filter, thereby causing electrical shorts and fusing or clogging jet engines. Fine ash is a nuisance and can cause respiratory problems, and heavy ash fall 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.

Hazard assessments for Augustine, Iliamna, Redoubt, Spurr, and Hayes indicate that the primary hazard from eruptions are from drifting volcanic ash clouds and fallout, which can affect animals and humans, and can disrupt air transportation activities at distances as far away as the license area (Waythomas and Waitt, 1998; Waythomas et al., 1998; Waythomas and Miller, 1999; Waythomas and Miller, 2002; Waythomas and Nye, 2002). The prevailing wind direction in Southcentral Alaska is from the west, and ash clouds from previous eruptions of Redoubt, Spurr, and Augustine traveled south and east over Canada and the Lower 48. Volcanic ash fall hazards from Cook Inlet volcanoes would be preceded by seismic activity, which normally is recorded at monitoring stations maintained by AVO on all the Cook Inlet volcanoes except for Hayes. AVO distributes updates and warnings for volcanoes that exhibit signs of potential unrest in order to mitigate hazards to air traffic and animals and people in surrounding areas. Based on past experience, it is expected that seismic activity would give warning of coming volcanic activity, and after a volcanic event, the prevailing winds would move ash away from the license area.

3. Flood Hazards

Flood hazards in the vicinity of the license area may result from ice jams or high rainfall floods on the Kuskokwim and Holitna rivers. The Cold Regions Research and Engineering Laboratory (CRREL) maintains an ice jam database that is populated largely from USGS gaging station information on discharge and peak stage, and from anecdotal reports from residents, news sources, or CRREL files (USCOE, 1999). The number of ice jams reported may vary depending on the location where the jam occurs and the stage at which a jam is reported. In Alaska, many ice jams may occur in unpopulated areas and are never reported. Also, the specific flood stage reported by USGS gaging stations will be different than the stage at which an ice jam may be reported by a local resident. Information on damage caused by ice jams in Alaska varies from lowland flooding, bank erosion, flooded homes and road damage (USCOE, 1997). The Kuskokwim River has 222 recorded ice jams in the database, the second highest number of recorded ice jams in Alaskan rivers. The town of Bethel has the highest number of ice jams recorded for Alaska towns, with 26 ice jams (USCOE, 1997).

Flooding from storm events may also occur in the license area. The National Weather Service (NWS) maintains an advanced hydrologic prediction service for the Kuskokwim River at Crooked Creek. The NWS Web site provides hydrographs showing river level changes over time and forecast hydrographs are posted during flood events. Flood stage on the Kuskokwim River is considered

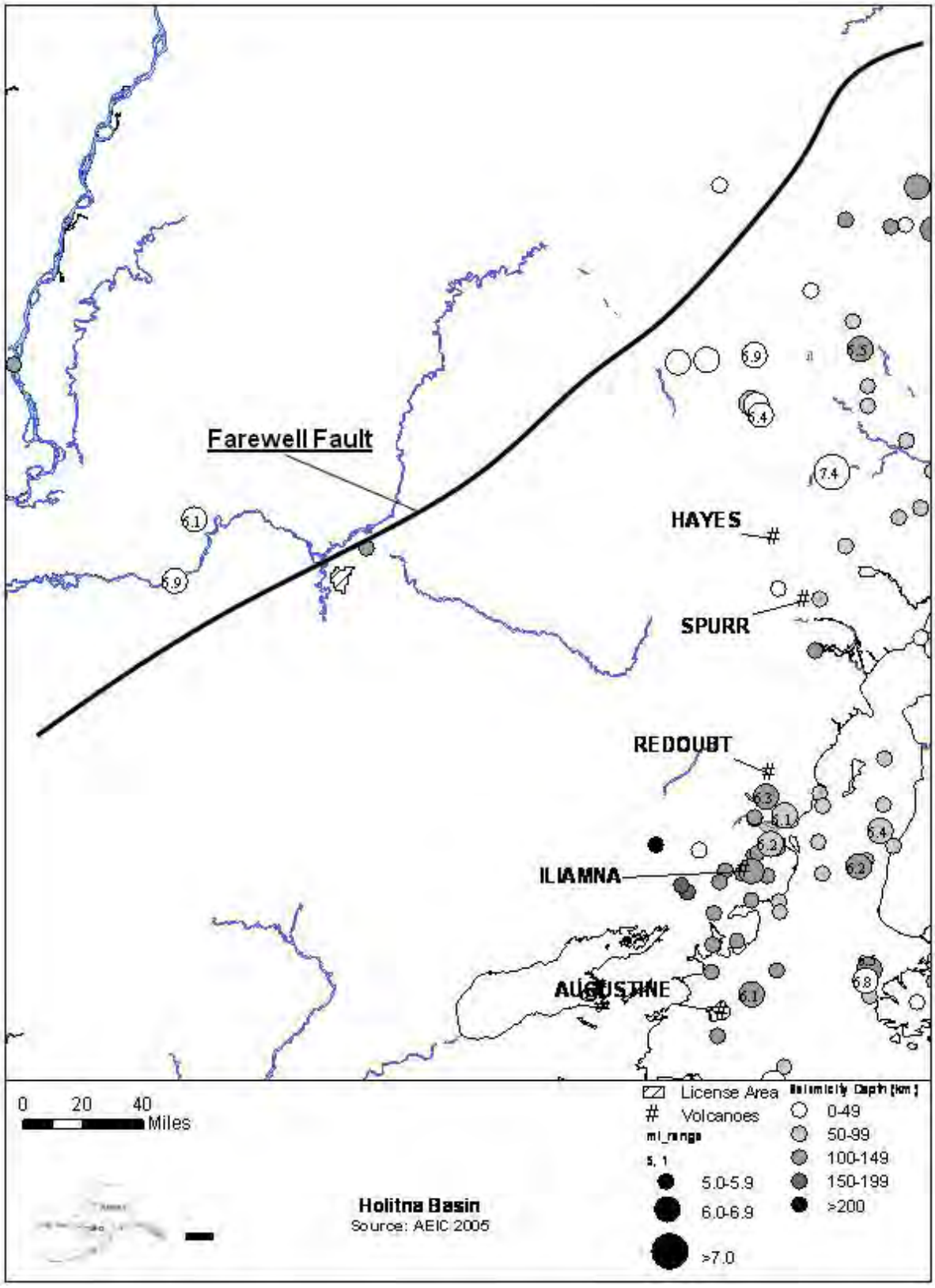


Figure 6.1. Volcano and historic earthquake epicenter locations.

24 ft.; the only recorded flood event was at 25.74 feet on June 6, 1964. Other recent events over 15 feet were recorded on May 16, 2002; May 19, 1999; July 11, 1998; and May 8, 1994 (NWS, 2005).

Two USGS stream gaging stations are on the Kuskokwim River close to the license area; one is located downstream at Crooked Creek, the other upstream at Lisky's crossing near the confluence with the Stony River. Both gage height and discharge are measured at the Crooked Creek station, and gage height is measured at the Stony River station when flow at the stations is not affected by ice. The discharge that produced the flood event in 1964 was 392,000 cubic feet per second. Other recorded peak streamflow discharges greater than 200,000 cubic feet per second since 1964 include events in 1985, 1972, and 1971 (USGS, 2005). In addition to hazards caused by high water levels, primary hazards to facilities from river flooding are bank erosion, high bed-load transport, and channel modification. Mitigation measures include setbacks from water bodies to mitigate many of the flood hazards. Additionally, plans of operation will be scrutinized carefully to ensure proper precautions were taken in areas of possible flooding.

Stream icings (naledi 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 causes flooding of facilities and other structures above the normal high watermark of nearby streams. During the spring, increased streamflow due to snowmelt may cause water to flow around the icing beyond the normal floodplain (Péwé, 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 (Péwé, 1982). These hazards are highly localized, however, and can be mitigated by careful evaluation and avoidance of susceptible areas.

4. Permafrost

Perennially frozen ground, or permafrost, exists where the ground temperature remains at or below freezing (32˚F or 0˚C) for at least two years. Permafrost is defined solely on the basis of temperature. Depending on the chemical composition of the water or the depression of the freezing point due to capillary forces, part or all of the moisture within permafrost may not be frozen. Additionally, it is possible to have dry permafrost, or permafrost without water and thus without ice (Péwé, 1982). While permafrost is primarily a feature of polar and subpolar regions, patches extend as far south as latitude 45˚N in the northern hemisphere (Péwé, 1982; Brown et al., 2001).

The Holitna Basin lies within the zone of discontinuous permafrost, where potentially as much as 50 to 90 percent of the area is underlain by perennially frozen ground (Brown et al., 2001). The visible ground-ice content in the upper 10 to 20 meters (32.8 to 65.6 feet) is considered low, ranging from 0 to 10 percent by volume. Landforms consist of lowlands characterized by thick overburden cover at least 5 to 10 meters (16.4 to 32.8 feet) thick (Brown et al., 2001). The most severe permafrost hazards result from the thawing of massive ground ice, including pore ice, segregated ice, ice-wedge ice, pingo ice, and buried ice. Ice wedges are generally inactive in the discontinuous permafrost zone (Péwé, 1982). Potential hazards resulting from permafrost include thawing of ground ice with subsequent surface subsidence; intensified frost action, such as heaving and ground cracking; and freezing of buried sewer, water, and oil lines (Péwé, 1982). Aboveground pipelines on a vertical support member (VSM) can be vulnerable to permafrost thawing. The VSM can conduct heat, which in turn thaws the permafrost. These hazards would be highly localized and limited in the area, however, and can be mitigated by careful evaluation, proper engineering, or avoidance of susceptible areas.

Seasonally frozen ground occurs throughout Alaska. During the winter, ice formation causes an upward displacement of ground known as frost heaving. The thawing of ice in the spring results in the loss of bearing strength and ability of the ground to support structures (Péwé, 1982). This is particularly problematic in areas with fine-grained soils, such as silt or clay (Péwé, 1982). Frost

heaving may result in extensive damage to aboveground structures such as bridges, roads, buildings, and airfields. Hazards due to frost heaving would be highly localized and can be mitigated by careful evaluation, proper engineering, or avoidance of susceptible areas.

5. Summary

Development in the license area may be subject to potential geologic hazards, including earthquake shaking, earthquake-induced ground failures, river floods, ice jams, minor stream icings, volcanic ash fall, and permafrost. There are no avalanche hazards in the license area, as relief is minimal and there are no adjacent slopes. All structures should be built to exceed minimum requirements of the 1997 Uniform Building Code for seismic zone 2B and/or the minimum requirements of the 2003 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. Proper site planning and engineering will minimize the potential effects of these natural processes.

B. Transportation

1. Pipelines and Their Components

Pipelines are the most likely method for transporting gas from the license area because geologists believe natural gas is far more likely to be encountered in commercial quantities than is oil, and the license is limited to gas only exploration. A pipeline system could be constructed for transporting natural gas to be made available to local markets near the license area. If far greater quantities of gas were discovered than are anticipated at this time, a gas transportation system extending beyond the communities near the license area could be considered. However, predicting the extent or location of new transportation facilities is not possible at the licensing phase.

a. Pipe

The diameter of the pipe used in gas pipelines can vary greatly. Generally, small pipe (0.5 to 6 inches in diameter) is used in gathering and distribution systems; mainline pipes, the principle pipe in a given system, are 16 to 48 inches in diameter. Most major interstate pipelines are 24 to 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 (API) (NGSA, 2005).

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 that are folded into a tube shape 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, 2005).

Pipe is also covered with a specialized coating to prevent corrosion caused by moisture. This coating commonly is a fusion bond epoxy, which gives the pipe a light blue color. In addition, cathodic protection, a method of preventing and inhibiting corrosion by running electric current through the pipe, is often used.

b. Compressor Stations

Gas pipelines use compressors to push natural gas through the lines 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 pipelines. The gas enters the compressor station, where it is compressed by a turbine, motor, or engine that is normally powered by a small portion of the natural gas that is being compressed. In addition to compressing the gas, compressor

stations also commonly contain some type of liquid separator, consisting of scrubbers and filters to capture any liquids or other undesirable particles from the natural gas in the pipeline, dehydrators to remove remaining water vapor, and heaters to prevent the formation of hydrates within the equipment (NGSA, 2005).

c. Metering Stations

The piped gas is measured and monitored by 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 but also can 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. The number and spacing of the block valves along a pipeline depends on the size of the pipeline and the expected throughput rate (Nessim and Jordan, 1986).

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 recent technological advances in leak detection systems (described in thenext section) increase the ease with which buried pipelines can be monitored. Third, burying pipelines may increase loss of wetlands because of the gravel fill. Finally, buried pipelines may not be feasible from an engineering standpoint because of the thermal instability of fill and underlying substrate (Cronin et al., 1994:10).

C. Gas Release and Oil Spill Risk, Prevention, and Response

1. Gas Release and Oil Spill Risk

The Holitna license area may contain coalbed methane gas and the license is for gas only exploration. Installation of blowout preventers in coalbed methane wells is a standard requirement and greatly reduces the risk of a gas release. If a release occurs, however, the released gas would dissipate unless it is ignited by a spark. Ignition could result in a violent explosion (Gerding, 1986). Other risks related to gas include a gas pipeline rupture, which could release small quantities of condensate liquids and could be similar in effect to a small petroleum spill (BLM, 2005).

The oil spill risks associated with gas development are much less than for oil field development because they address only the possibility of incidental and very small oil spills associated with vehicles.

2. Prevention and Response

The technology for monitoring gas pipelines 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 and roundness, check for signs of corrosion, detect minute leaks, and check for 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.

In addition to inspection using pigs, a number of precautions and procedures are routinely used to minimize the risk of accidents, including (NGSA, 2005):

- **Aerial Patrols**: Planes can be used to ensure no natural or human-caused events threaten the integrity of the pipeline.
- **Leak Detection**: Natural gas detecting equipment is used periodically 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 shutdown 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. In computational pipeline monitoring, the main category of internal leak detection systems, 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 (ADEC, 1999). The three main categories of computational pipeline monitoring are volume balance, pressure analysis, and real-time transient modeling systems (ADEC, 1999).
- **Pipeline Markers**: To reduce the chance of any interference with the pipeline, signs on the surface above natural gas pipelines indicate the presence of underground pipelines to the public.
- **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.
- **Preventative Maintenance**: Valves are tested and surface impediments are removed to allow pipeline inspection.
- **Vapor Sensing**: Vapor sensing detection systems are used more frequently 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 (ADEC, 1999).
- **Pipeline Inspection**: ADEC regulations governing pipelines require all buried pipelines to be corrosion prevention by protective wrapping or coating and by cathodic protection, and all seams must be welded (no claps or threaded seams are allowed). The ADEC-approved corrosion control program must be followed; aboveground pipe must be inspected at least monthly, and support members designed to be stable and composed of materials that 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. Response procedures for gas releases or oil spills must be fully described by the licensee if operations are proposed. At that time, site- and operation-specific details of response capabilities will be required to the extent necessary and before operations are permitted.

Mitigation measures to ensure safe and environmentally responsible operations included in this finding address siting of facilities and pipelines, and handling and disposal of hazardous wastes including drilling muds and cuttings. A complete list of mitigation measures and licensee advisories is found in Chapter Seven.

Chapter Seven: Mitigation Measures and Licensee Advisories

Table of Contents

Page

A. Mitigation Measures 7-1
1. Facilities and Operations 7-1
2. Fish and Wildlife Habitat 7-2
3. Subsistence, Commercial, and Sport Harvest Activities 7-3
4. Fuel, Hazardous Substances and Waste 7-3
5. Access 7-4
6. Prehistoric, Historic, and Archeological Sites 7-5
7. Local Hire, Communication, and Training 7-5
8. Definitions 7-5
B. Licensee Advisories 7-6
1. ADF&G 7-6
2. ADEC 7-6
3. USCOE 7-7
4. USFWS 7-7

Chapter Seven: 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/lease 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.

These measures were developed after considering terms imposed on earlier exploration licenses, competitive lease sales, and comments and information submitted by the public, local governments, environmental organizations, and other federal, state, and local agencies. Additional measures will likely be imposed when the licensee submits a proposed plan of operations.

Licensees must obtain approval of a detailed plan of operations from the Director before conducting exploration, development, or production activities. A plan of operations must identify the sites for planned activities and the specific measures, sequence and schedule of operations, design criteria, transportation activities, 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. ADNR will provide at least a 30-day public notice for plans of operation, which may be longer if ADNR finds that the plan of operation raises new issues of significant public interest.

Licensees must comply with all applicable local, state and federal codes, statutes and regulations, as amended, 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.

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 feasible and prudent, 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. The decision whether to grant an exception will be made during the public review of the plan of operations.

Abbreviations mean: Alaska Department of Environmental Conservation (ADEC), Alaska Department of Fish and Game Habitat Division (ADF&G), Alaska Department of Natural Resources (ADNR), Alaska Oil and Gas Conservation Commission (AOGCC), Commissioner (ADNR Commissioner), ADNR Division of Mining, Land and Water (DMLW), ADNR Division of Oil and Gas (DO&G), National Marine Fisheries Service (NMFS); ADNR Office of Project Management and Permitting (OPMP); ADNR State Historic Preservation Officer (SHPO), U.S. Army Corps of Engineers (USCOE), and U.S. Fish and Wildlife Service (USFWS).

A. Mitigation Measures

1. Facilities and Operations

a. Permanent facilities shall not be constructed during the exploration phase. Exploration activities will utilize existing road systems, ice roads, or vehicles that cause minimal damage to the ground surface or vegetation. Construction of temporary roads may be allowed. Facilities must be designed and operated to minimize sight and sound impacts in areas of recreational and subsistence use 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.

b. The siting of facilities other than docks, roads, utility or pipeline corridors, or terminal facilities will be prohibited within 1/4-mile of the banks of the Holitna and Hoholitna Rivers, and within 500 feet of all fish bearing water bodies. 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 feasible or prudent 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.

c. Impacts to identified wetlands must be minimized to the satisfaction of the Director, in consultation with ADF&G and ADEC. 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 Advisory B(1)(a)).

d. The operator will minimize disturbance of vegetation within rights-of-way during construction, maintenance and operational activities.

e. 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.

f. Gravel mining within an active floodplain is prohibited, unless the Director, with the concurrence of 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.

g. If gas is produced from a lease converted from this exploration license, local communities shall have priority access to the gas at reasonable rates, to address their local energy needs.

h. Dismantlement, Removal and Rehabilitation: 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 governments and tribal organizations, and any non-state surface owner, determines that such removal and rehabilitation is not in the their best interest.

2. Fish and Wildlife Habitat

a. Detonation of explosives within or in proximity to fish bearing waters must not produce instantaneous pressure changes that exceed 2.7 pounds per square inch in the swim bladder of a fish. 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 upon request. The location of known fish bearing waters within the project area can be obtained from the 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 1.

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 0.1 inches unless another size has been approved by ADF&G. The maximum water

velocity at the surface of the screen enclosure must be no greater than 0.2 feet per second unless a higher 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. 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 shall not be conducted within ½-mile of known occupied brown bear dens, unless alternative mitigation measures are approved by 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 (McGrath, 907-524-3323). Mobile activities shall avoid such discovered occupied dens by ½-mile unless alternative mitigation measures are approved by the Director with concurrence from ADF&G. Non-mobile facilities will not be required to be relocated.

f. 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.

g. The Director, in consultation with ADF&G, may impose seasonal restrictions on activities located in and adjacent to important waterfowl habitat during the plan of operations approval stage.

h. The licensee is required to prepare and implement a human-bear interaction plan designed to minimize conflicts between bears and humans. The plan should 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 the inclusion 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. provided 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.

3. Subsistence, Commercial, and Sport Harvest Activities

a. License- related use will be restricted when the Director determines it is necessary to prevent conflicts with local subsistence, commercial and sport harvest activities. In enforcing this term DO&G, during review of plans of operation, will work with other agencies, the affected local governmental organizations 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, seasonal drilling restrictions, and other technologies deemed appropriate by the Director.

4. Fuel, Hazardous Substances and Waste

a. Secondary containment shall be provided for the storage of fuel or hazardous substances.

b. Containers with an aggregate storage capacity of greater than 55 gallons which contain fuel or hazardous substances shall not be stored within 100 feet of a water body.

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 five 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 or lease area. The operator will ensure the emergency services director, village public safety officer and local fire service area office is provided information concerning the use or transport of any hazardous substances associated with exploration and development.

g. Vehicle refueling shall not occur within the annual floodplain, except as addressed and approved in the plan of operations.

h. Waste from operations must be reduced, reused, or recycled to the maximum extent practicable. Garbage and domestic combustibles must be incinerated whenever possible or disposed of at an approved site in accordance with 18 AAC 60.

i. 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.

j. 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/lease activities. Disposal sites may be provided for drilling waste if the facility complies with ADEC regulations.

k. A plan of operations will include a disclosure 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.

l. 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. Injection of non-hazardous wastes is regulated by AOGCC through its Underground Injection Control (UIC) Program for oil and gas wells.

5. 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 Alaska statute.

6. Prehistoric, Historic, and Archeological Sites

a. Prior to the construction or placement of any 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 SHPO 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 SHPO and the local borough, 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 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 SHPO and local governmental organizations, has directed the licensee as to the course of action to take for its preservation.

7. Local Hire, Communication, and Training

a. To the extent they are available and qualified, the licensee is encouraged to employ local and Alaska residents and contractors for work performed on the license/lease area. The licensee shall submit, 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 and hire local and Alaska residents and contractors. The licensee is encouraged, in formulating this proposal, to coordinate with employment services offered by the State of Alaska and local communities to train and 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 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.

8. Definitions

In this document:

a. "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;

b. "Feasible and prudent" means consistent with sound engineering practice and not causing environmental, social, or economic costs that outweigh the public benefit to be derived from compliance with the standard;

c. "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];

d. "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;

e. "Plan of operations" means a lease Plan of operations under 11 AAC 83.158 and a unit Plan of operations under 11 AAC 83.346;

f. "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 plus 12 inches of freeboard. Double walled tanks do not qualify as Secondary Containment unless an exception is granted for a particular tank.

g. “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.

h. “Permanent facility” means a facility that will remain at a single location for period in excess of six months.

B. Licensee Advisories

Licensee advisories are intended to alert the licensee to possible additional restrictions that may be imposed at the permitting stage of a proposed project or activity in certain license areas, especially where entities other than DO&G have permitting authority.

1. ADF&G

a. Under the provisions of Title 16 of the Alaska Statutes, the measures listed below may be imposed by ADF&G below the ordinary high water mark to protect designated anadromous water bodies 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 provisions of Regulations for Appropriation and Use of Water (11 AAC 93.035 - 11 AAC 93.147).

2. ADEC

a. The licensee must comply with state regulations administered by ADEC and AOGCC regarding requirements for an oil discharge prevention and contingency plan (C-Plan). If AOGCC determines a C-Plan is required, the licensee will, prior to commencing operations, address how

[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 Part 122.2, 230.3, and 232.2).

a spill response would occur, spill prevention measures at the facility, and supplemental information to provide background and verification information.

b. Unless authorized by an ADEC permit, surface discharge of reserve pit fluids and produced waters is prohibited.

c. Unless authorized by NPDES or state permits, disposal of wastewater into freshwater bodies is prohibited.

3. USCOE

a. Any activity involving wetland-related dredge or fill activities requires a permit from the USCOE.

4. USFWS

a. Bald eagles are protected under the Bald Eagle Protection Act (16 U.S.C. 668-668c) and the Migratory Bird Treaty Act of 1918 (16 U.S.C. 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 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. The licensee is advised of the need to comply with the Migratory Bird Treaty Act (MBTA)(16 U.S.C. 703) which is administered by the U.S. Fish and Wildlife Service. Under the Migratory Bird Treaty Act, it is illegal to take migratory birds, their eggs, feathers or nests. "Take" is defined to include "pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting" (50 CFR 10.12). 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.

   In order to ensure compliance with the MBTA, it is recommended that the licensee 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 the licensee contact the U.S. Fish and Wildlife Service for assistance and guidance on survey needs, and other compliance issues under the Migratory Bird Treaty Act. While the U.S. Fish and Wildlife Service can recommend methods (such as surveys and timing windows) to avoid unintentional take, responsibility for compliance with the MBTA rests with licensee.

Chapter Eight: Reconsideration, Decision, and Signatures

Table of Contents

Page

A. Reconsideration 8-1
1. Purpose of Exploration Licenses 8-1
2. Points Raised by HEC 8-2
a. Coal Bed Methane 8-3
b. Size of License Area and Mitigation Measures 8-3
c. Community Support 8-4
3. Matters Required by AS 38.05.133(f) and AS 38.05.035(e) and (g) 8-5
a. Property Description and Petroleum Potential 8-5
b. Fish, Wildlife, and Habitats 8-6
c. Current and Projected Uses 8-6
d. Governmental Powers 8-7
e. Reasonably Foreseeable Cumulative Effects and Mitigation Measures 8-7
i. Water 8-7
ii. Air 8-7
iii. Fish and Wildlife Habitats and Populations 8-7
iv. Uses of Fish and Wildlife Habitats and Populations 8-9
v. Archeological, Cultural, and Historic Resources 8-9
f. Statewide and Local Fiscal Effects and Mitigation Measures 8-9
g. Municipal and Community Effects and Mitigation Measures 8-10
h. Other Considerations 8-11
i. Geophysical Hazards 8-11
ii. Likely Methods of Transportation 8-11
B. Final Best Interest Finding Decision on Remand 8-12

Chapter Eight: Reconsideration, Decision, and Signatures

AS 38.05.133(f) requires that the commissioner issue a written finding of whether an exploration license serves the state's best interests.

After reexamining the October 2, 2006 final finding, considering and discussing the matters required by AS 38.05.133(f), weighing the reasonably foreseeable, significant positive and negative effects of issuing the license, considering all public comments received, considering the purpose of exploration licenses, and considering the additional information submitted by HEC in its request for reconsideration, the commissioner has concluded that issuing an exploration license to HEC is in the state's best interests.

On August 1, 2005 ADNR issued a preliminary best interest finding, preliminarily concluding that Holitna's exploration license proposal would best serve the interests of the State of Alaska. The final best interest finding issued October 2, 2006 concluded that the project was not in the state's best interest. On October 5, 2006, HEC requested reconsideration and asked for additional time to submit additional information, which was submitted on November 20, 2006. The request for reconsideration was granted on November 28, 2006. On June 20, 2007, the commissioner affirmed the final finding, as issued, and denied the reconsideration request. On July 20, 2007, HEC appealed ADNR's decision to superior court. On March 18, 2008, ADNR submitted an unopposed motion to remand HEC's appeal, and on March 19, 2008, the court remanded the case to ADNR. Additional detail is found in Chapter One.

Following is a summary of matters considered by the commissioner in reconsidering the October 2, 2006 final finding; and the commissioner's decision on remand that issuing an exploration license to HEC is in the state's best interests.

A. Reconsideration

In reconsidering the final finding, the commissioner has considered the purpose of exploration licenses; points raised by HEC in its November 20, 2006 letter; and matters required by AS 38.05.133(f), AS 38.05.035(e) and (g).

1. Purpose of Exploration Licenses

In May 2003, HEC submitted an application to ADNR to obtain a lease to explore for shallow natural gas and coal bed methane on state land within the Holitna Basin, near the confluence of the Holitna River and Basket Creek outside the village of Sleetmute. In 2004, after HEC submitted its lease application, HB 531 passed in the 2004 legislative session. HB 531 authorized any applicant with pending shallow natural gas applications to convert those applications to noncompetitive exploration licenses. On July 2, 2004, HEC submitted a request to convert shallow natural gas applications ADL 390390 through 390394 and 390605 to an exploration license application under HB 531. The Holitna Basin exploration license is for natural gas only. Even though the geology of the Holitna Basin 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 would have to shut down operations and contact the department.

Exploration licensing supplements the state's conventional oil and gas leasing program by targeting areas outside known oil and gas provinces. 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. Through exploration licensing, the state receives

valuable subsurface geologic information on these regions and, should development occur, revenue through royalties and taxes.

ADNR said in both the preliminary and final findings that, "[g]iven the estimated low potential for gas in the Holitna Basin, the contribution of this project to any of these end results is expected to be insignificant." However, this is true of all exploration license projects. Their contribution to the state's economy is small compared to North Slope oil and gas development, which contributed more than $11.2 billion in fiscal year 2008 and provides more than 90 percent of the state's general fund unrestricted revenue. There are benefits besides taxes and royalties from exploration licensing as the state receives valuable subsurface geologic information on areas with relatively low or unknown petroleum potential. Still the October 2, 2006 final finding did list some economic benefits:

> An exploration license may create a small number of new jobs in the local economy for short-term employment during the exploration phase. The long-term employment benefits of a license in the Bethel Census Area and local communities will depend on the subsequent production of commercial quantities of gas. Direct employment in support of a CBM development, including construction, development, operations, maintenance, and support, is estimated to be 80 people. The number of jobs in related employment – in the service, transportation, utilities, and retail sectors of local economies – would depend on project success and size. Local communities may fill 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, could stimulate the local economy.

ADNR found the petroleum potential for the Holitna Basin to be poor to fair for conventional gas and that it did not meet the criteria for commercial CBM. However, in spite of this poor to fair potential, the preliminary finding still found the proposed Holitna Exploration License to be in the state's best interest. The very intent of exploration licensing is to encourage exploration in areas far from existing infrastructure, with relatively low or unknown hydrocarbon potential. HEC also submitted new information that stated the potential for conventional gas was higher than previously thought.

Thus, the commissioner finds that the exploration license proposed by HEC meets the purposes of the exploration license program, a factor which was not given enough consideration in the October 2, 2006 final finding.

2. Points Raised by HEC

On August 1, 2005, ADNR issued a preliminary finding in which the director concluded that the exploration license proposal would best serve the interests of the State of Alaska, and that the potential benefits of the Holitna Basin Exploration License, as conditioned, outweighed the possible adverse impacts. The preliminary finding was subject to revision based on comments received during the 60-day public comment period. The division accepted both written and oral comments, and held public hearings in Aniak, Sleetmute, Crooked Creek, Red Devil, and Bethel in September 2005.

Fourteen months later, on October 2, 2006, ADNR issued its final finding. It reversed the preliminary finding and concluded that the HEC exploration license proposal was not in the state's best interest.

On November 20, 2006, HEC submitted a request that the commissioner reconsider his October 2, 2006, decision. HEC's request for reconsideration provided supplemental information and clarifications upon which it based its request that the commissioner reconsider HEC's application for exploration in the Holitna Basin.

a. Coal Bed Methane

HEC's first point in its request for reconsideration was to relinquish its rights to coal bed methane (CBM) because it recognized CBM as one of the major concerns by locals and because it is confident that there is great potential for conventional natural gas. Both the preliminary and final best interest finding contained Appendix D, which discussed coalbed methane wells and stated:

> CBM pilot projects usually involve four to five wells, with one well in the center and the other wells surrounding it. A development plan would involve a larger number of wells spread over a large area. The well density would be dependent on the nature of the coal, the sensitivity of the area to surface impacts, and the technology available. Each CBM well site will require a gravel pad containing one well within an enclosure, an enclosed generator to operate the pump or hydraulic system, a gas-separator and metering skid, and a storage tank for produced water surrounded by a spill containment dike. Depending on the projected size of the field, more than one pilot project could be necessary to adequately evaluate the prospect.

The department did not carefully consider HEC's relinquishment of its rights to CBM in rendering its final finding. Upon reexamination, the commissioner agrees with HEC that HEC's decision to relinquish its rights to CBM significantly reduces the scope of the license application and avoids many potential environmental effects in the license area.

b. Size of License Area and Mitigation Measures

HEC's second point in its request for reconsideration was that it disagreed with ADNR's conclusion that due to the small size of the proposed license area, mitigation measures would not be protective of fish and wildlife habitat.

In its final finding ADNR stated:

> The preliminary finding included mitigation measures intended to minimize impacts and enhance the positive aspects of the proposed exploration license. DO&G received significant comments on the proposed mitigation measures. In review, DO&G has concluded that no mitigation measure is sufficient. Typical mitigation measures drafted to protect valuable resources by avoiding activities in sensitive areas would be ineffective in this instance, due to the fact that the small proposed license area entirely includes uniquely sensitive spawning and over-wintering habitat. The small size of the license area (26,791 acres) makes it difficult to condition the license in a manner that allows exploration activities to occur harmoniously with the other uses in the area and without impact to sensitive fish and wildlife resources. Additionally, the project has very little support and the project proponent has not proactively garnered such support. For these reasons and upon consideration of all comments received, DO&G has concluded that the project is not in the state's best interest.

To mitigate the potential adverse effects of specific license/lease related activities, the department proposed mitigation measures to condition plans of operation, exploration, or development. The preliminary finding contained 37 proposed mitigation measures and 9 proposed licensee advisories.

Mitigation measures are conditions or limitations, in addition to those imposed by statute, to ensure that a resource disposal is in the state's best interests. These proposed measures were developed after considering terms imposed on earlier exploration licenses, competitive lease sales, and comments and information submitted by the public, local governments, environmental organizations, and other federal, state, and local agencies. Additional measures may be imposed when the licensee submits a proposed plan of operations.

Licensee advisories are intended to alert the licensee to possible additional restrictions that may be imposed at the permitting stage of a proposed project or activity in certain license areas, especially where entities other than DO&G have permitting authority.

Licensees must obtain approval of a detailed plan of operations from the director before conducting exploration, development, or production activities. A plan of operations must identify the sites for planned activities and the specific measures, sequence and schedule of operations, design criteria, transportation activities, construction methods, and operational standards to be employed to comply with the mitigation measures

HEC said that ADNR's suggested mitigation measures, such as buffers and protected areas along critical stream habitat, only restrict a small percentage of the license area and that the remaining acreage is more than sufficient to develop the necessary quantities of gas for the Donlin Creek Mine and the regional population for many generations.

Under AS 38.05.132(c)(2), an exploration license may cover, subject to the maximum acreage limitation on exploration licenses by one licensee under AS 38.05.131(e), an area of not less than 10,000 acres and not more than 500,000 acres, that must be reasonably compact and contiguous. At 26,791 acres HEC's exploration license exceeds the minimum requirement under the regulation.

ADNR knew the size of HEC's exploration license area when it accepted the application, and when it issued its preliminary best interest finding, which concluded that the license was in the state's best interest and that potential negative effects could be mitigated.

ADNR developed the mitigation measures contained in the preliminary finding in cooperation with what was then the Office of Habitat Management and Permitting (OHMP) and which is now the Habitat Division of the Alaska Department of Fish and Game. In its comments, OHMP did not express any concern about the size of the proposed license area nor did any members of the public.

The final best interest finding did not explain why it found the license area adequate in size to successfully implement mitigation strategies in the preliminary finding, but then found the license area "too small" in the final finding.

Whether a particular mitigation strategy will be successful will not be known until a specific activity is proposed. Licensees must obtain approval of a detailed plan of operations from the director before conducting exploration, development, or production activities. Additional mitigation measures may be imposed on a site-specific, case-by-case basis depending on what is proposed, where it is proposed, and what values are to be protected.

Upon reexamination, the commissioner finds there is no evidence to support the conclusion that the size of the proposed license area makes it too difficult to condition the license in a manner that allows exploration activities to occur harmoniously with other uses in the area and without impact to sensitive fish and wildlife resources.

c. Community Support

In its third point, HEC committed to working with local community representatives to identify specific and workable project design, scheduling, and operation standards that will minimize impacts to fish and wildlife and their habitats, as well as to subsistence uses. HEC also asked for an additional 120-day period (through March 19, 2007) "to develop and document local support" for the project. ADNR denied the request for additional time.

ADNR in its final finding said that HEC's project had very little support and that HEC has not proactively garnered such support. However, ADNR denied HEC's request for additional time to develop such support for the project. Additionally, because HEC recognized CBM as one of the major concerns by locals, it relinquished its right to develop CBM, which may have significantly

decreased local opposition to the project. HEC stated its belief that local support will balloon by removing CBM concerns, by working with local residents to protect fish and game populations and habitat as well as subsistence uses of fish and game, and also by committing to hiring locally.

Therefore, the commissioner finds that the department's conclusion that the project has very little local support was premature and did not consider HEC's commitment to working with local residents. Future public involvement will continue to shape the project, and concerns of local residents will be taken into account during permitting that occurs in phases subsequent to licensing.

3. Matters Required by AS 38.05.133(f) and AS 38.05.035(e) and (g)

In reconsidering the October 2, 2006 final finding, the commissioner has considered and discussed in this document the following matters set out in AS 38.05.035(e) and (g), as required by AS 38.05.133(f):

i. the property descriptions and locations;

ii. the petroleum potential of the license area;

iii. the 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 oil and gas exploration, development, production, and transportation;

vi. the reasonably foreseeable cumulative effects of oil and gas exploration, development, production, and transportation on the license area, including effects on subsistence uses, fish and wildlife habitat and populations and their uses, and historic and cultural resources;

vii. license and subsequent lease stipulations and mitigation measures, including any measures to prevent and mitigate releases of oil and hazardous substances, to be included in the license and any subsequent leases, and protections offered by these measures;

viii. the methods most likely to be used to transport oil or gas from the license area, and the advantages and disadvantages and relative risks of each;

ix. the reasonably foreseeable fiscal effects of the exploration license and the subsequent activity on the state and affected municipalities and communities; and

x. the reasonably foreseeable effects of oil and gas exploration, development, production, and transportation on the municipalities and communities within or adjacent to the license area.

Following is a summary of these matters that have been considered and weighed by the commissioner in reconsidering the final best interest finding.

a. Property Description and Petroleum Potential

The license area lies near the confluence of the Holitna River and Basket Creek, approximately 10 miles southeast of Sleetmute. The state owns both the surface and subsurface estates of the license area. Gravimetric data indicate the basin is as deep as about15,000 feet. Because well and seismic subsurface data are lacking, basin stratigraphy is poorly understood and largely extrapolated from surrounding surface outcrops and other Tertiary basins in central Alaska. One study has indicated a poor potential for commercial quantities of oil in the Holitna Basin and poor to fair potential for commercial quantities of gas. Another study has indicated that the potential for conventional gas and oil is low. Surface exposures of coals observed in the Holitna Basin area do not appear to indicate presence of coalbed methane. Shallow gas may be present, and the estimated gas potential in the Holitna Basin is 100 to 200 billion cubic feet which, although not commercial, could be used for local consumption.

b. Fish, Wildlife, and Habitats

The Holitna Basin area includes a variety of habitats and a diversity of fish and wildlife species that support recreational and subsistence activities for residents and visitors to the area. Most habitats and populations of fish and wildlife in the area are healthy. All five species of Pacific salmon are found in the area, as well as lake trout, Arctic char, and Dolly Varden. Other resident fish species include Arctic grayling, northern pike, sheefish, burbot, broad whitefish, humpback whitefish, and round whitefish.

Large numbers of waterfowl utilize the extensive wetland habitat associated with the drainages of the Holitna, Hoholitna, and Stony rivers, which are tributaries of the Kuskokwim River. Western and Interior Alaska provide breeding, resting, and staging habitat for waterfowl migrating from the Pacific, Central, and Atlantic flyways, with waterfowl arriving before breakup in April or May and staying until after freeze-up in October. Some important waterfowl species of the area include ducks; white-fronted, Canada, and lesser Canada geese; and trumpeter swans. Cranes and several species of raptors are also found in the Holitna Basin.

No known calving concentration areas for caribou occur in the Holitna Basin. The Mulchatna caribou herd is sometimes found in the area, particularly during years of population growth when its winter range may expand into the area. The herd has been observed migrating through the area during a few years.

The entire license area is a known moose winter concentration area. The corridors along the Holitna and Hoholitna rivers are known moose calving and rutting concentration areas, and calving and rutting concentration areas occur inside the license area. Moose also use the area for summer habitat and movement between the Holitna and Stony rivers. Concerns over a declining moose population important to both resident and nonresident hunters prompted the Alaska Board of Game to establish a wolf control program in 2004.

Other mammals in the license area include brown bears, black bears, wolves, and several species of furbearers. The Holitna Basin is not within the known range of any species listed as threatened or endangered.

c. Current and Projected Uses

The Holitna River, Hoholitna River, and Basket Creek drainages, and Big Lake are important subsistence use areas for residents of Sleetmute and surrounding villages. Subsistence users hunt moose, bear, and caribou. They may also trap, hunt migratory birds, and fish for species such as whitefish and salmon. The area is also important for sport hunting of big game, particularly moose and caribou. Both resident and nonresidents participate in sport hunting. Sport fishing is important for local residents who guide anglers targeting Chinook salmon, northern pike, and sheefish.

The Holitna Basin exploration license is consistent with the Kuskokwim Area Plan. Among the plan's goals are economic development and making coal, oil and gas, and geothermal resources available to contribute to national and state energy and mineral supplies and independence. The plan specifies that primary surface uses are to be forestry, wildlife habitat, and water resources in subunits 15a and 15c. However, all state lands within the planning area are available for oil and gas exploration and leasing. The plan provides guidelines for oil and gas development, including exploration techniques that minimize clearing, removal of abandoned facilities, pipeline design, and worker education. Mitigation measures and other regulatory protections will be sufficient to ensure that exploration, development, production, and transportation that may occur in phases subsequent to licensing will be consistent with the area plan.

d. Governmental Powers

All gas activities (exploration, development, production, and transportation) are subject to numerous federal, state, and local laws, regulations, policies, and ordinances, with which the licensee is obligated to comply. ADNR requires plans of operation, geophysical exploration permits, temporary water use authorizations, permits and certificates to appropriate water, land use permits, and material sale contracts. Specific statutes govern the protection of cultural and historic resources. ADEC oversees air quality permits, solid waste disposal permits, wastewater disposal permits, NPDES certification, and oil discharge prevention and contingency plans. ADF&G has permitting authority for activities that may affect anadromous fish streams, and requires a Fish Habitat permit for any activity that may affect the efficient passage of resident fish. The AOGCC requires permits to drill, regulates the underground disposal of Class II oil field wastes, and requires permits to inject fluids into a well annulus. Federal authorities for regulating gas activities include the EPA, U.S. Army Corps of Engineers, and PHMSA.

e. Reasonably Foreseeable Cumulative Effects and Mitigation Measures

i. Water

Water quality characteristics could be affected if an accidental spill of fuel, lubricants, or chemicals occurred. If conducted improperly, exploration and development activities could result in increases in erosion and sedimentation, causing elevated turbidity. If disposed of improperly, drilling muds and produced water might also impact water quality.

The discharge of drilling muds and cuttings into lakes, streams, rivers, or important wetlands is prohibited. Surface discharge of reserve pit fluids and produced waters is prohibited unless authorized by ADEC permit. Impacts to important wetlands must be minimized. Licensees must also comply with the federal Clean Water Act and obtain NPDES permits. ADEC certifies that these discharge permits will not violate the state's water quality standards. ADEC also certifies U.S. Army Corps of Engineers dredge and fill permits in wetlands and navigable waters to ensure compliance with state water quality standards.

ii. Air

Routine activities associated with gas exploration, development, and production that might affect air quality are emissions from construction, drilling, and production. Air pollutants may include nitrogen oxides, carbon monoxide, sulfur dioxide, particulate matter, and volatile organic compounds. Sources of air emissions during drilling operations may include rig engines, camp generator engines, steam generators, hot-air heaters, incinerators, and well test flaring equipment. Gas blowouts may also affect air quality.

ADNR has not developed mitigation measures for air quality because they are covered under existing statutes and regulations. All industrial emissions must comply with the Clean Air Act (42 U.S.C. §§ 7401-7642) and state air quality standards. AS 46.03 provides for environmental conservation including water and air pollution control and radiation and hazardous waste protection. 18 AAC 50 provides for air quality control including permit requirements, permit review criteria, and regulation compliance criteria. 18 AAC 50.300 establishes standards for air quality at certain facilities, including gas facilities, at the time of construction, operation, or modification.

iii. Fish and Wildlife Habitats and Populations

Potential impacts to fish in the exploration phase include degradation of stream banks and overwintering areas due to erosion and sedimentation. Potential impacts to fish in subsequent phases include habitat loss due to gravel displacement and facilities siting; interference with migration and movement from onshore structures and impoundments; and fish kills due to industrial water use,

unregulated discharge, and seismic activities. Long-term positive impacts may include habitat improvement from restoration and rehabilitation of impacted sites.

AS 16.05.841 and AS 16.05.871 regulate activities that may affect anadromous waters or that may result in blockage of fish passage. Licensee advisories specify that alteration of riverbanks and use of in-stream equipment is prohibited. Bridges or non-bottom-founded structures will be required for crossing fish spawning and important rearing habitats. Mitigation measures are expected to avoid, minimize, or mitigate potential negative effects on fish. Discharge of drilling muds and cuttings into lakes, streams, rivers, and high value wetlands is prohibited. Disposal of produced waters will be by subsurface disposal techniques. Unless authorized by a state permit, disposal of wastewater into fresh waters is prohibited. Gravel mining within an active floodplain is prohibited. Removal of water from fish bearing rivers, streams, and natural lakes is subject to prior written approval by DMLW and ADF&G. Water intake pipes must be designed to prevent harm to fish. Use of explosives is prohibited in open water areas of fish-bearing waters.

Bird populations of the license area could be affected by gas exploration, development, or production activities. Potential impacts include habitat loss, barriers to movement, and disturbance during nesting and brooding. However, mitigation measures are expected to avoid, minimize, or mitigate potential negative effects on birds of the area. To protect bird populations in the license area, the siting of new facilities in identified wetlands and sensitive habitat areas may be restricted. Facilities must be sited at least 1/4 mile from the Holitna and Hoholitna rivers and 500 feet from fish-bearing streams and waters. Permanent facilities will be prohibited within 330 feet of bald eagle nests, whether active or inactive. Lining, dike placement, and buffer zones are required to protect aquatic habitats. Well-pad spacing will be reviewed and approved as part of a unit plan of development. The plan of operations will include the measures to be used to mitigate potential noise impacts associated with facilities and compressor stations.

Vegetation clearing and construction of roads and pads in the license area could result in a loss of some caribou or moose habitat. Some habitat loss could also occur from the displacement of animals due to noise and activity. Noise and disturbance that might affect caribou and moose include: seismic surveys; construction of facilities such as roads, pads, and pipelines; vehicle traffic; aircraft over-flights; and drilling and production activities. More roads and increased vehicle traffic could also result in increased mortality from collisions.

To protect caribou and moose populations, permanent roads may not be used for exploration, and activities must be supported by air service or an existing road system where possible. Wherever possible, pipelines must use existing transportation corridors. Additionally, pipelines must be buried where soil and geophysical conditions permit. In areas where pipelines must be placed above ground, pipelines must be sited, designed, and constructed to allow free movement of moose and other terrestrial animals. Impacts to identified wetlands must be minimized. Facilities must be sited at least 500 feet from all fish-bearing water bodies. Well-pad spacing will be reviewed and approved as part of a unit plan of development.

During exploration, brown and black bears could potentially be affected by disturbances during denning. During development and production, human activity may attract foraging bears to facilities, especially refuse disposal sites. This may pose a threat to human safety and the potential need to shoot animals that have become habituated to humans or garbage.

Garbage must be incinerated whenever possible. Facilities may not be sited within one-half mile of the Holitna and Hoholitna rivers and 500 feet of all fish-bearing water bodies. Construction of permanent roads will not be approved for exploration activities. Exploration and development activities started between October 15 and April 31 may not be conducted within one-half mile of occupied brown bear dens, unless alternative mitigation measures are approved by ADF&G. Exploration activities must utilize existing road systems, ice roads, air or boat service, or vehicles

that do not cause significant damage to the ground surface or vegetation. Construction of temporary roads may be allowed. For projects in close proximity to areas frequented by bears, licensees are encouraged to prepare and implement bear interaction plans to minimize conflicts between bears and humans.

iv. Uses of Fish and Wildlife Habitats and Populations

Effects on subsistence, commercial, and sport activities in the license area could include increased access to resources by competing users, and land use limitations and restrictions on access to subsistence activities. Potential benefits from gas development activity include increased wage earning opportunities to supplement subsistence activities, and better access to hunting and fishing areas which could increase subsistence harvests.

The licensee, including any contractors and subcontractors, must train employees about local environmental, social, and cultural concerns to increase sensitivity and understanding of community values, customs, and lifestyles of local residents. 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. No license facilities or operations may be located so as to block public access to or along navigable and public waters as defined by state law. During review of plans of operation or development, DO&G will work with other agencies and the public to assure that potential conflicts are identified and avoided. Plans of operation submitted for review and approval must describe the licensee's efforts to communicate with local communities and interested local community groups. A plan of operations will include an analysis of road and access issues associated with site development. All aspects of transportation related to the proposed activity, the possible effects of the activity on existing uses, and implementation of mitigation measures will be considered in review of plans of operation. Additional site-specific and project-specific mitigation measures may be imposed, as necessary, to protect subsistence, commercial, and sport uses.

v. Archeological, Cultural, and Historic Resources

While no historical or archeological sites have been reported in the study area, there is the potential of new sites being discovered. Prehistoric and historic archaeological resources could be affected by activities 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 can include: direct breakage of cultural objects; damage to vegetation and the soil thermal regime, leading to erosion and deterioration of organic sites; and shifting or mixing of components in sites resulting in loss of association between objects. Crews at archaeological or historic sites could also damage, destroy, or displace sites by collecting artifacts.

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. In the event that any site, structure, or object of prehistoric, historic, or archaeological significance is discovered during license operations, the licensee must immediately report such findings to the director. These measures will ensure these resources are protected and preserved. Additionally, state laws prohibit the removal of historic and cultural resources. Violators are subject to criminal (misdemeanor) penalties and civil penalties, including fines up to $100,000 (AS 41.35.210, 215).

f. Statewide and Local Fiscal Effects and Mitigation Measures

The Holitna exploration license area is located in the ADNR Kuskokwim Planning Area. Among the Kuskokwim Area Plan's goals are economic development and making coal, oil and gas, and

geothermal resources available to contribute to national and state energy and mineral supplies and independence. The Holitna Basin exploration license supports these goals.

The primary source of state revenues is North Slope oil production. In FY 2004, oil and gas revenues comprised approximately 87 percent 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. Regardless of the price of crude oil and natural gas, general fund receipts are likely to continue to decline (see Chapter Five).

When the exploration license is issued, there will be a onetime increase in state income from the $1 per acre licensing fee. At 26,791 acres, this license will result in a fee of $26,791. The potential for additional revenue from rentals, royalties, and taxes is unpredictable because it is unknown what reserves may be found in the area. Given the estimated low potential for gas in the Holitna Basin and the small scale of the project, further revenues from this license are expected to have an insignificant effect on overall state revenue.

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 contributes to the wellbeing of both the state and local economy.

The statewide fiscal effects are anticipated to be positive and relatively small; no mitigation measures were developed for this topic.

An exploration license may create a small number of new employment opportunities in the gas industry, 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 Holitna Basin area including Red Devil, Crooked Creek, Aniak, Sleetmute and other local communities, will depend on the subsequent production of commercial quantities of oil and gas. Gas development and the potential to reduce local energy costs is also a possible effect to the local economy.

The local fiscal effects are anticipated to be positive, and no mitigation measures were developed for this topic.

g. Municipal and Community Effects and Mitigation Measures

The Holitna Basin region is a remote area in interior Southwestern Alaska. The study area lies near several small villages including Red Devil, Crooked Creek, and Sleetmute. Benefits could result at the local and community level from the issuance of a Holitna Basin exploration license. Employment opportunities may develop during the exploration phase and more during development and production phases, should they occur. The long-term employment benefits to boroughs and local communities would depend on the subsequent production of commercial quantities of gas, the hiring of local residents, and the use of local service providers.

If gas is found, residents in 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.

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. 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 probably be temporary, limited to the construction and exploration timeframes.

Other financial and infrastructure impacts could be more long term if development ensues. Employment effects could be both short and long term.

To the extent they are available and qualified, licensees are encouraged to employ local and Alaska residents and contractors for work performed in the licensed area. Prior to beginning work, licensees submit, 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 and hire local and Alaska residents and contractors. The licensee 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.

A plan of operations must describe efforts to minimize impacts on residential, commercial, and recreational areas. Facilities must be designed and operated to minimize sight and sound impacts in areas of high residential, commercial, recreational, and subsistence use and important wildlife habitat. Public access and use cannot be restricted, except within the immediate vicinity of drill sites, buildings, and related facilities, and public access to navigable and public waters cannot be blocked.

h. Other Considerations

i. Geophysical Hazards

The primary geophysical hazards within the license area include earthquakes, faulting, volcanic activity, flood hazards, and permafrost. These geophysical hazards could impose constraints to exploration, production, and transportation activities and should be considered prior to any siting, design, or construction of facilities.

Structures in the license area must be built to meet or exceed the Uniform Building Code requirements for Zone 2B, areas of moderate earthquake probability. Predevelopment planning should include surveys of spring breakup activity, as well as flood-frequency analyses. Structural failure can be avoided by proper facility setbacks from rivers and main tributaries. Containment dikes and berms can be installed to reduce flood damage.

ii. Likely Methods of Transportation

If phases subsequent to licensing occur, elevated or buried flow, gathering, and common carrier pipelines would probably carry natural gas from wellheads to processing centers. If not designed properly, elevated pipelines can restrict wildlife movements, especially if accompanied by a road with regular vehicle traffic. Elevated pipelines are easy to maintain and visually inspect for leaks. Buried pipelines have little impact on wildlife, except for some potential habitat loss from gravel fill, but they are more difficult to monitor and maintain because they cannot be visually inspected. Buried pipelines are sometimes not feasible from an engineering standpoint because of the thermal instability of fill and underlying substrate.

Mitigation measures require that pipelines be designed and constructed to allow free movement of moose, caribou, and other terrestrial animals. Wherever possible, pipelines must utilize existing transportation corridors, and be buried where soil and geophysical conditions permit. The plan of operations will include an emergency preparedness and response plan for potential emergencies that may be associated with the operation of facilities.

B. Final Best Interest Finding Decision on Remand

Upon reexamination of the facts and conclusions in the final finding, matters set out in AS 38.05.035(e) and (g), and points raised by HEC in its November 20, 2006 letter, the commissioner concludes that the potential benefits of the Holitna Basin exploration license, as conditioned, outweigh the possible adverse impacts, and that the exploration license will serve the best interests of the state of Alaska.

This is a final administrative order and decision of the department for purposes of an appeal to Superior Court. An appellant affected by this final order and decision may appeal to Superior Court within 30 days in accordance with the rules of the court, and to the extent permitted by applicable law.

Kevin R. Banks, Director — December 9, 2009 Date

I concur with the director that the Holitna Basin exploration license is in the best interests of the state.

Thomas E. Irwin, Commissioner — December 9, 2009 Date

Appendix A: Summary of Comments and Responses

Comments received in response to the Preliminary Finding of the Director for the Holitna Basin Exploration License, issued on August 1, 2005, are summarized below. Responses to each comment are also provided. Section A contains common issues identified by several commenters. Section B provides summaries of individual comments, arranged in alphabetical order, and responses to each.

A. Common Issues

ISSUE RAISED	RESPONSE
Common Issue 1: Subsistence, and Fish and Wildlife	
The Yukon-Kuskokwim Delta is a very important subsistence area of Alaska. The upper Kuskokwim is the only region in Alaska where subsistence plays a larger role than cash in the local economy. How can ADNR assure subsistence users that these subsistence uses and resources will be protected and available for future generations?	The reasonably foreseeable effects of the project on fish and wildlife populations and habitats, and subsistence user are discussed in Chapters Four and Five. The finding includes numerous mitigation measures to avoid, minimize, or mitigate potential negative effects. Mitigation measures are set out in Chapter 7. Mitigation measures address siting of facilities and pipelines, restrictions on construction during the exploration phase, protecting wetlands and vegetation, restrictions on gravel mining, restrictions on the use of explosives, protections for fish-bearing streams and anadromous waters, protection of bears, caribou, moose, and waterfowl, conflicts with subsistence users, proper handling and disposal of hazardous substances, access for subsistence harvest activities, and employee training.

Common Issue 2: Kuskokwim Area Plan and Protection of Fish and Wildlife Habitat	
The State of Alaska Kuskokwim Area Plan for State Lands (1988) provides: "the emphasis of state land management in the Holitna management unit is protection of the fish and wildlife habitat, and support for continued subsistence, commercial and sport use of these resources." Additionally, while the area is not officially designated a Critical Habitat Area, ADF&G has classified the area as A-2 Special Value Habitat Area (habitats with fish and wildlife and related human use values of regional or statewide significance and include the most intensive or highest quality	The Kuskokwim Area Plan is discussed in Chapters Three and Four. Additionally, a discussion of the reasonably foreseeable effects of the project on fish and wildlife habitat and populations is found in Chapter Five. Gas development is consistent with the overall Kuskokwim Area Plan, with subunit 15 of the plan, and with ADF&G A-2 Special Habitat Area classification. The Kuskokwim Area Plan specifically allows for oil and gas exploration and development within the license area and calls for multiple use management (see Chapters Two and Three of the Kuskokwim Area Plan). Current and projected uses of the exploration license area and reasonably foreseeable effects of the project on the area were considered and discussed in Chapters Four

public use areas or the most productive fish and wildlife habitats). The entire project area is sensitive and/or critical habitat for several species of wildlife, spawning grounds for several species of fish, and nesting grounds for several species of migratory birds. The proposed gas exploration and development is inconsistent with these management goals.	and Five of the finding. ADNR exploration licenses are subject to mitigation measures that are imposed in addition to other state, federal, and local requirements. The mitigation measures provide direction on how ADNR will exercise its management authority as it relates to proposed activities on those leases and are imposed throughout all phases of the project, including exploration, development, and production. Mitigation measures and plans of operation provide adequate environmental protections. Additional conditions may be required for approval of plans of operation if specific activities in specific locations are proposed.

Common Issue 3: Water Quality and Reinjection	
How will water quality in the Holitna Basin be monitored? Will all CBM wastewater be reinjected? A large amount of contaminated water will be dispersed, thereby creating the chance of wiping out the subsistence salmon stock and whitefish species. Pumping contaminated water back into the ground will be expensive and will contaminate other wells. How will reinjection affect the environment?	It is necessary to properly manage produced water from CBM production. However, all CBM-produced water does not necessarily contain harmful contaminants. All CBM-produced water is not the same and the water at particular production areas must be tested before any conclusions can be reached about the produced water quality and characteristics. Accordingly, the produced water from each production area should be managed individually. The wastewater permitting requirements of ADEC protect the waters of the state by ensuring that state water quality standards are met. Similarly the U.S. Environmental Protection Agency, under the authority of the Clean Water Act, ensures that federal water quality standards are met. Both goals are achieved through implementation of the National Pollutant Discharge Elimination System (NPDES) permitting system, described in Chapter One, with which the licensee is required to comply. If the discharge of produced water will meet water quality standards, prohibiting the discharge is unnecessary . AOGCC regulates wastewater reinjection. Wastewater is reinjected deep enough so there is no communication between the wastewater and the groundwater, which prevents contamination of the groundwater. Reinjection and other reasonably foreseeable effects of the project on water quality are discussed in detail in Chapter Five of this final finding. See also Mitigation Measure A(4)(l). Additionally, plans of operation approvals may include monitoring requirements to mitigate potential impacts

	on water quality, which would be tailored to the specific situation and potential impacts. HB 531, passed in 2004, mandates that AOGCC 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 available to the public. Further, the law prohibits AOGCC from permitting a well 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.

Common Issue 4: Hydrology of Area	
Little is known about the hydrology of the Holitna Basin. How will CBM development, particularly reinjection, affect the hydrology? ADNR should require a complete hydrological study of the Holitna Basin prior to any exploration activities taking place.	It is not feasible to conduct the type of aquifer study requested on all lands subject to exploration licenses. Not only would such a study be expensive and time-consuming, but it is likely that most of the data generated would never be relevant to a gas permitting decision, given the uncertainty of gas exploration. Therefore, allocating limited state agency resources to such an effort would not be cost effective. HB 531, passed in 2004, requires AOGCC to 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 available to the public.

Common Issue 5: Reclamation and Bonding	
Does ADNR require the applicant to post bonds? Will these bonds be sufficient to cover the costs of any damages done as a result of the gas exploration and/or development? How will ADNR ensure that the area is properly reclaimed after gas exploration and/or development?	In accordance with AS 38.05.132(c)(4) and 11 AAC 82.945, ADNR requires the licensee to post, and maintain throughout the term of the license, a performance bond or other security. A statewide bond secures payment for possible damage to public resources. If the exploration license is converted to a lease, the state may require a larger bond 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 to be carried out under the lease. The plan of operations, which must be approved by ADNR prior to undertaking operations in the licensed area, must include plans for rehabilitation of the area after completion of operations or phases of those operations. The license allows for ADNR inspection of

	the licensed area and all mitigation measures are fully enforced through all stages of the license, including reclamation.

Common Issue 6: Public Notice and Involvement	
Adequate notice was not given; the public did not have adequate opportunity to be involved in the best interest finding process; and the timing conflicted with subsistence activities.	ADNR follows public notice requirements according to AS 38.05.945. Public notice and hearing requirements have been met or exceeded for this best interest finding. ADNR is required to provide public notice to all villages and communities in the project vicinity that will be directly affected by the project (see Chapter Four for a list of communities in the project vicinity). ADNR sent public notices to local communities, ANCSA corporations, postmasters (for posting), and nonprofit community organizations. Additionally, display ads were sent to newspapers with regional circulations in the project area, and the public notice was posted on DO&G's Web site and ADNR's public notice Web site. On October 22, 2004, ADNR issued a Notice of Intent to Evaluate an Exploration License Proposal and Call for Comments. Public comments were accepted through 5 p.m. on December 21, 2004. ADNR conducted public informational meetings, which are not required by statute, in Aniak, Crooked Creek, and Sleetmute on March 14-15, 2005. On August 1, 2005, ADNR issued the preliminary finding for the Holitna Basin exploration license. ADNR accepted public comments through 5 p.m. on September 30, 2005. Public hearings were held in Aniak and Sleetmute on September 26, and Crooked Creek and Red Devil on September 27. ADNR held an additional hearing in Bethel on September 28, which is outside the project area, in order to hear comments from people who value the project area for subsistence and other uses but do not reside in the project's vicinity. Concerning timing conflicts with subsistence activities, ADNR held public meetings at two different times, in March and in September. In addition, a 60-day (two-month) public comment period is required by law for preliminary best interest findings (AS 38.05.035(e)(5)(A)) to ensure the public has sufficient time to comment. The public comment period for the Holitna exploration license preliminary best interest finding was 60 days.

Common Issue 7: Concern and/or Dissatisfaction with Statutes or Regulations	
Concerns were raised about several bills that made changes to state oil and gas programs, the Alaska Coastal Management Program, and other regulatory programs.	AS 38.05.035(g) lists the topics that DO&G must consider and discuss in the best interest finding analysis (see Chapter One of this final finding). Best interest findings must determine whether the proposed activity serves the best interests of the state. In 2002, the Division of Habitat within ADF&G became the Office of Habitat Management and Permitting (OHMP) and was moved from ADF&G to ADNR. See Chapter One for more discussion on OHMP/ADF&G's regulatory authority as it pertains to oil and gas exploration and development. HB 69, passed in 2003, modified AS 46.04.030 to exclude shallow natural gas exploration and production. In 2005, however, the statute was again amended; it currently provides: "A person may not cause or permit the operation of a pipeline or an exploration or production facility in the state unless an oil discharge prevention and contingency plan for the pipeline or facility has been approved by the department and the person is in compliance with the plan." HB 69 also allowed the commissioner to approve a waiver of local planning authority approval and requirements relating to compliance with local ordinances and regulations if the department demonstrated an overriding state interest. This provision was repealed by Sec. 58 ch 49 SLA 2004 (see AS 38.05.177(o); AS 38.05.125). Effective July 1, 2008, Executive Order 114 moved OHMP back to ADF&G, where it became the Division of Habitat again. HB 191 and HB 86, passed in 2003, modified the Alaska Coastal Management Program, procedures for consistency reviews, and rendering of consistency determinations under that program. It also moved the ACMP from the Alaska Coastal Policy Council to ADNR. Advocating for or commenting on changes to statutes or regulations is beyond the role of ADNR in the best interest finding process, and beyond the scope of review of best interest findings. ADNR has followed the statutory framework established by the legislature for this best interest finding.

B. Individual Comments

Comment Number	COMMENT OR SUGGESTION	RESPONSE
Albertson, LaMont: Bethel Meeting, September 28, 2005		
1.	I am really troubled by the way this process has been handled, not only because of the lack of biological information on the environmental area, but also the process of trying to make people understand what is happening. One thing that troubles me is the time of year – September is not a good time to get people together to discuss important matters. There has been a tremendous lack of community involvement. The process has really been hurried and there has been a dearth of information in terms of the process.	The finding provides sufficient biological information on fish and wildlife populations and habitats of the Holitna license area to determine if the exploration license is in the best interests of the state. See response to Common Issue 6.
2.	The lack of communication is best exemplified by the lack of a translator at this hearing. I am embarrassed on behalf of the state that this hearing has not been handled in a better manner. A large percentage of our constituents here in the Yukon-Kuskokwim Delta do not grasp what's at stake here in the way this thing is being structured. It would be best for ADNR to go back to Juneau or Anchorage, find a better time, and just put off making this decision. Make an effort to honestly educate us and get us involved in your process. There is not a doubt in my mind that our lifestyle will demand the exploitation of every energy resource that we have in the Delta in time – but now is not the right time.	ADNR apologizes for not having a translator present at the Bethel public hearing. In the future, ADNR will coordinate with the community in evaluating whether a translator is needed and will work with local communities to provide a translator, where necessary. See also response to Common Issue 6.
Andrew, Lydia, of Kasigluk: Bethel Meeting, September 28, 2005		
3.	We are against it because if something happened to the Kuskokwim River it will still touch us, even up on the tundra. Our elders say that in the fall, our food, whitefish and pike, go down	See response to Common Issue 1.

	to the Kuskokwim River and then in the spring they go up.	

Andrew, Noah, of Toluksak: Bethel Meeting, September 28, 2005		
4.	I oppose the project. I am concerned about reclamation. The reclamation requirements approved by the state and federal governments have not been monitored to date. Nobody will monitor or inspect the reclamation. The federal and state governments have a responsibility to protect the tribes. I have not seen a reclamation that I approve of so far. We do not have jobs in the morning – nobody making money to put food on the table. We gather ours from the waters, the source, the basin.	Opposition noted. See response to Common Issue 5. As for monitoring the project, the mitigation measures are a term of the license and compliance with them is mandatory. All mitigation measures will be enforced, including throughout phases subsequent to leasing. DO&G is fully staffed and funded to monitor the project and enforce the mitigation measures and permit stipulations.

Atmautluak Traditional Council, Atmautluak: Letter of September 29, 2005		
5.	The Atmautluak Traditional Council submitted Resolution 05-28: A Resolution by the Atmautluak Traditional Council Opposing the Proposed Coalbed Methane Development in the Holitna Basin.	Opposition noted.

Cannon, David, of Aniak: Bethel Meeting, September 28, 2005		
6.	At the Aniak meeting this spring I questioned the state's representative as to water quality testing and the person said at that time, since there was going to be reinjection required, there wouldn't be a need for water quality testing. And here, you stated that somehow it was missed in this draft best interest finding and that it probably would be included in the future. How much public involvement is really listened to?	All comments received are considered in developing a best interest finding. Comments are used to identify and research issues pertinent to the decision, to formulate policy, including specific restrictions in the mitigation measures, and to inform decision making. As for reinjection and water quality, see response to Common Issue 3.

Cannon, David, of Aniak: Letter of September 30, 2005		
7.	Although the preliminary finding states that all potential hazardous materials will likely be reinjected, it is possible that this will not be the case. Nothing in the finding guarantees that the water quality will not be degraded and there is no water-quality monitoring plan anticipated throughout the life of this project. There is no baseline data to compare future contamination.	See response to Common Issue 3.
8.	While public notices have been put in the local papers and sent to local organizations, normal communication standards do not apply to remote areas. Many meetings and comment periods have occurred at inappropriate times, such as hunting, gathering, and fishing times.	See response to Common Issue 6.
9.	I ask that you incorporate by reference all comments sent in by the Sleetmute Traditional Council and any other local entities or individuals on previous public testimony for CBM gas applications (ADL 390390-390394 and 390605) and the land use permit MLUP/AK03-7.	The preliminary best interest finding is ADNR's best effort at incorporating, researching, and addressing all comments received on prior oil and gas projects in the area, as well as all comments received on the subject project since its inception. The preliminary best interest finding is then available for public comment, to ensure that important issues have been addressed. The final finding responds to all comments received on the preliminary best interest finding during the public comment period (August 1 through September 30, 2005). Comments made on prior projects or submitted prior to the preliminary best interest finding have been addressed, and therefore will not be incorporated by reference or responded to individually again in this document.

Carlson, Barbara: Sleetmute Meeting, September 26, 2005		
10.	I am concerned that no baseline data has been taken before the exploration is started. If something went wrong, certainly the bonding would not cover what had happened – in many ways there is no way to correct something like this once it has gone wrong.	Habitat, fish, bird and mammal species, villages and communities, subsistence and sport harvest uses, and economic activities of the Holitna Basin are considered and discussed in chapters Three and Four, and provide sufficient information to determine that the exploration license is in the state's best interest. See also responses to Common Issues 2, 3, 4, and 5.

Carlson, Barbara, of Sleetmute: Letter of September 27, 2005		
11.	I do not feel that the state should grant Holitna Energy an exploration license in the Holitna Basin. The area has only poor to fair potential for a minimal amount of gas. With Donlin Creek mine no longer interested in using this gas to generate electricity, how could it possibly be economical to construct a pipeline from the gas field to the surrounding small villages? The Denali Commission has just pumped millions of dollars into the Middle Kuskokwim River villages to improve diesel storage and generation systems – it seems a poor time for the state to say it's in its best interest to switch to another source of power.	Many interests and concerns must be balanced in determining whether an activity is in the state's best interest. A cost benefit analysis is not required. The petroleum potential is uncertain until exploration occurs. However, if commercial quantities of natural gas are located, the costs associated with heating and power generation for local villages and communities may be reduced. Mitigation Measure A(1)(g) requires the licensee to provide a portion of produced gas to local communities first.
12.	With Unit 18 closed to moose hunting, the hunting pressure on the already heavily hunted Holitna drainage has noticeably increased.	Hunting opportunities and pressures could increase in the Holitna area due to activities involved with gas exploration, development, and production. However, these effects can be mitigated through the hunting regulation process. Reasonably foreseeable effects on caribou and moose are discussed in Chapter Five.
13.	The state knows very little about CBM development and how it can impact fish and game. The state also knows very little to nothing about the hydrology of the area and its aquifers. The waters are what make this area rich in fish and game. Contamination is likely due to the lack of any knowledge of how different layers of water interact; the project area is a floodplain and nothing requires reinjection of the water. I personally heard Phil St. George talk about building holding ponds for this water. To hold for how long?	See responses to Common Issues 2, 3 and 4. In addition, Mitigation Measure A(4)(i) states: "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."

Carlson, Roy, of Sleetmute: Letter of September 27, 2005		
14.	A study indicates that water wells up to 20 miles away are affected. This project has the potential to destroy the drinking water for three villages. Has anyone in your office consulted with	The Village Safe Water Program is located within the ADEC. The ADEC Commissioner is on DO&G's mailing list and received all public notices associated with this project. ADEC has authority and responsibility, through

	the Village Safe Water program about potential effects? Why is there no mention of natural springs?	permitting, inspection and water testing, to ensure the protection of water quality. If the discharge of properly permitted water will meet water quality standards, then there is no justification to prohibit the discharge. See also Licensee Advisories B(2)(b) and (c). See also responses to Common Issues 3 and 4.
15.	The AOGCC requires the operator to design and implement a water well testing program to provide baseline data on water quality and make it available to the public. Is this done before any drilling is to be permitted? Why are natural springs and surface water not included in this testing program? Does the EPA not require baseline data on wells in the affected area?	See responses to Common Issues 3 and 4. The operator must design and implement a water well testing program as a condition of approval of a permit to drill a well or production or production testing. Chapter One discusses individual agency responsibilities with regard to oil and gas exploration and development.
16.	Is a determination of financial responsibility that the licensee must have resources – money, assets or a bond – to cover the cost of any potential damages required?	Alaska statute does not require consideration of ownership or business history at the proposal phase of an exploration license. See response to Common Issue 5.
17.	How is the value of drinking water to be determined? Why is there no mention of groundwater in the mitigation measures? Is nothing to be done to protect groundwater?	See response to Common Issue 3.
18.	Mitigation measures deal with injection but earlier stated wastes and produced waters were to be reinjected. I understand injection to mean not in the ground anywhere and reinjection to mean to put back in the ground at the same level it came from.	See response to Common Issue 3.
19.	The cost of living analysis demonstrates a lack of knowledge and poor research. Bethel is a hub for the area only for barge traffic and governmental health services. No groceries are “shuffled” through Bethel. The hub communities for the area for mail, air freight, and charters are Anchorage and Aniak.	The final finding states that Bethel is the hub for the Bethel Census Area and Aniak is the service hub for surrounding villages. Fuel oil is still barged upriver from Bethel.
20.	There is no market for the gas, should it be found. The Donlin Creek mine	See response 11.

	has stated publicly that they are not interested. Local markets are so few and far between that gas could not be supplied without government subsidies for the infrastructure, which is already in place for diesel and oil heat. Why start over with another fuel?	
21.	ADNR should not risk the groundwater for the area, multimillion-dollar village safe water projects, and private wells to look for gas. The license would not put enough into the local economy to affect anything. The amount of money generated by this license will not even cover the cost of processing the paperwork, let alone all the ongoing monitoring of the drilling and exploration, should it be permitted.	DO&G must balance many interests and concerns in determining whether an activity is in the state's best interest.

Carney, Doug: Bethel Meeting, September 28, 2005		
22.	In 2003, when Holitna Energy applied for a land use permit to drill core holes, the people of Sleetmute and Red Devil went to the meetings and 60 people out of a population of 80 adults all signed and concurred with Sleetmute Traditional Council and sent it to ADNR. Since now the original applications are allowed to convert into new exploration licenses, we darn well want our comments incorporated by reference included. You don't throw that all out – it is part of the permanent record. We didn't get all those people together and spend money to get us together to have you say it doesn't count. It's the same issue.	See response 9.
23.	In 1996, HB 394 took the data requirement for best interest findings out. No baseline water study. But this is stuff that all of mining and oil are still required to do – they took it out for CBM specifically. Up to that point, the ADNR commissioner decided if the development benefited the local	See response to Common Issue 7, and see also responses to Common Issues 3 and 4 for information on water quality, hydrology, and required studies.

	community. Now it is changed to whether it benefits the state. Then in 2002, HB 69 exempted CBM waste from solid waste and water pollution laws. And also in that House bill were provisions that local laws can't override state laws. Then the Governor moved ADF&G OHMP over to ADNR. In summer 2004, HB 531 passes, requiring a best interest finding but still no baseline water study.	
24.	Records of all fluids used in drilling and fracturing should be public records. A lot of this information has been proprietary but it should not be.	A plan of operations application is required prior to, and fully describing, any proposed activity, including materials and methods to be used. Plans of operation are public noticed during the review and approval process.
25.	The 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 the people. You don't develop one resource at the expense of others. Also, the constitution says that the people own its resources.	This exploration license is consistent with management of state lands under the constitutionally-based principle of concurrent multiple use. The exploration license is also consistent with the Kuskokwim Area Plan. Current and project uses and resource values in the license area were considered, along with measures to balance protection of the environment, the various public uses, and gas exploration and development. Mitigation measures are designed to protect these various uses and environmental quality. Based on review of information available at this time, ADNR foresees no adverse impact on other uses in the license area at the license award phase, nor from reasonably foreseeable license related activities.
26.	Once somebody knows what CBM is and what is done, they don't want any part of it, unless it's the developer or the guy who owns the subsurface rights.	Comment acknowledged.
27.	The preliminary best interest finding says a person may appeal to the Superior Court only if the person was eligible to request and requested reconsideration at the agency level. I am doing that right now so I don't miss it.	A person who is aggrieved by this finding may request the commissioner to reconsider the decision under AS 35.05.035(i) and (j). See Chapter Eight for specific information regarding a request for reconsideration.
28.	There is no reinjection requirement listed in there – it says by subsurface disposal techniques, but there are lots	See response to Common Issue 3.

	of those. It's all pretty much wetlands, not technically wetlands but it is floodplain, floating vegetation, and muskeg. We have seasonal flooding there many years.	
29.	The best interest finding says there will be no direct discharge of produced water without a state permit. Why under any circumstances would the state give a permit to do that? What about treating the water? It says the water will be treated to drinking-water quality. That makes sense if you are going to inject it into a shallow aquifer but not if you are going to dump it into the river because drinking water specs are not good enough for fry and a lot of fish species.	See Common Issue 3.

Cascadia Wildlands Project, Gabriel Scott of Cordova: Letter of September 30, 2005		
30.	It is entirely unreasonable to expect a lay person to read, understand, and meaningfully comment on best interest findings. The real measure of public involvement isn't whether it complies with the statutes, but whether it informs people. Public information and comment is being passed down to future phases of the project, by which time it will be too late. For instance, public review of the plan of operations is not adequate to address environmental issues. The critical phase is issuing the license – approval of future permits is mandatory on agencies.	Phasing is allowed, and this project meets the criteria for phasing, which is explained in Chapter One. An exploration license grants the licensee exclusive rights to subsurface mineral interests; however, an exploration license does not authorize subsequent activities. The licensee's rights to drill for, extract, remove, clean, process, and dispose of any gas or associated substances that may underlie the lands described by 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 One contains a discussion of all of the required permits, including the public processes associated with the permits.
31.	While AS 38.05.035(e)(1)(C) allows for restricted analysis in multiphased development, ADNR must consider whether it would "void through review of the project or … avoid consideration of potential future	A phased review allows the licensing analysis to focus only on the issues pertaining to the licensing stage and the reasonably foreseeable, significant effects of licensing. This project meets the criteria for phased review, and phasing has been clearly upheld by the courts. See the detailed discussion concerning phasing

	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, 5 (1 I), SLA 1994; and Thane Neighborhood Ass'n v. City and Borough of Juneau, 922 P.2d 901, 908 (Alaska 1996)).	in Chapter One.
32.	Chapter Five is misleading because the scope of the best interest finding is limited to issuing the license, but drilling is discussed in general terms. It is difficult to determine what ADNR considers to be reasonably foreseeable.	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.
33.	Comparing shrinking production pad sizes on the North Slope to the Holitna license area is a false comparison. Pad sizes at Prudhoe Bay shrink largely due to the field maturing and better understanding of the local geology – these local advantages couldn't possibly carry over to Holitna.	While it is true that field maturation and a better understanding of the geology are responsible for a portion of the reduction in production pad sizes on the North Slope, most of the reduction in pad size is attributable to advancements in drilling technology over the last 30 years, which would be applicable to the Holitna area.
34.	The best interest finding fails to adequately consider the cumulative effects of the proposed gas exploration and development. This project is connected to development of the Donlin Creek mine, which is going to have massive cumulative effects. In Appendix A of the preliminary finding, ADNR writes, "gas development in the proposed license area may provide a cost-effective energy source for the nearby Donlin Creek mining project…". But the finding fails to consider the impacts of the project on the mine. ADNR is aware of general and probable impacts of the mine and could draw broad conclusions about needed	The discussions in Chapters Four, Five and Six meet the requirements of AS 38.05 and are sufficient to determine if the exploration license is in the best interests of the state. Reasonably foreseeable effects are defined in response 32. 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." It is impossible to predict the extent of development prior to exploration. Estimating gas reserves is a complex process. Even with the most technologically advanced scientific tools, exploration is required to determine if economically recoverable gas is present. It is possible that no discoveries will be made and no development will take place. If development does take place, mitigation measures

	infrastructure.	provided in the finding will be sufficient for avoiding, minimizing, or mitigating potential impacts.
35.	Please reveal project impacts on subsistence and subsistence users. Subsistence is not a job, it is a way of life that must be able to continue.	See response to Common Issue 1.
36.	ADNR did a good job of explaining the habitat values of the area but failed to apply this information to the risks of the proposal. The finding fails to consider the extensive local and traditional knowledge.	See response to Common Issue 1. Additionally, DO&G worked with local Native leaders to identify local landmarks and gather traditional knowledge about subsistence practices in the study area. DO&G also consulted with the Division of Parks and Outdoor Recreation, Office of History and Archaeology to identify any reported archaeological sites in the area.
37.	The management intent for the lands in the 1988 Kuskokwim Area Plan and ADF&G's A-2-quality habitat classification are not compatible with industrial development.	See response to Common Issue 2.
38.	Geophysical exploration and seismic testing is likely to negatively impact forested areas, including the possibility of a spruce bark beetle outbreak.	Any geophysical exploration, including seismic testing, requires a geophysical exploration permit issued by DO&G (11 AAC 96.005). The permit will contain measures to protect the land and resources and all activities must comply with the exploration license mitigation measures. Additionally, see Licensee Advisory 4.
39.	ADNR should redraw the boundaries of the license area to exclude Big Lake and protect swans that nest and stage on the lake. Or ADNR should redraw the boundaries to exclude Big Lake and the Hoholitna River, both of which are critical waterways.	Mitigation measures will minimize impacts to the physical environment. It is impossible to predict the extent of development prior to exploration. As specific projects are proposed, habitat use evaluations will be completed during the plan of operations review and additional mitigation measures will be imposed, if necessary. Accordingly, it is not necessary to delete acreage from the licensing area.
40.	ADNR failed to consider the cumulative negative impacts of massive industrial development on moose. A critical impact of issuing this license is increased hunting pressure, particularly on moose.	Cumulative impacts were considered and discussed in Chapter Five. See response 12 also.
41.	CBM has never been successfully done in wetland areas, especially not ones underlain by permafrost.	Mitigation measures in this finding, stipulations that may be deemed necessary to approvals of plans of operation, water quality protections provided by ADEC and EPA, and wetland protections provided by the U.S. Army Corps of Engineers are adequate to protect area wetlands.
42.	ADNR did a great job of discussing water quality and wetlands but failed	See responses 32 and 41.

	to apply that information to actual foreseeable effects. We have next to no faith in the NPDES permit system to protect water quality.	
43.	Does ADNR anticipate that ice roads would be used here?	Ice-snow roads and pads are commonly used for winter exploration to minimize environmental impacts. However, ice roads and pads should not and cannot be required in the Holitna area because experience indicates that freeze-thaw periods during winters in the region are not uniform or predictable, and favorable conditions for the construction and viability of ice structures cannot be relied upon. Ice road integrity also depends on site-specific soil conditions. DO&G discourages the use of gravel roads for exploration and encourages the use of ice roads where possible to minimize impacts.
44.	CBM exploration and development could have disastrous impacts to the water table and wetlands. Impacts will be greater because so little is known about local hydrology. Please don't allow reserve pits as a disposal method, but it also isn't reasonable to expect reinjection.	See responses to Common Issues 3 and 4.
45.	For purposes of mitigation measures, what are important wetlands? All wetlands in this place are important.	Mitigation Measure A(1)(c) has been changed to "Impacts to identified wetlands…" and definition A(8)(c) has been changed to incorporate the definition of "identified wetlands" used by the Army Corps of Engineers, which has jurisdiction over wetlands.
46.	The AOGCC requirements for water well testing programs aren't adequate – please require the operator to fund tests of all water wells. Baseline data for surface and subsurface hydrology must be gathered before drilling.	See responses to Common Issues 3 and 4. AOGCC has been given regulatory responsibility for monitoring water well testing programs.
47.	The finding gives the incorrect impression that issuing this license will enable local villages to plug themselves into a low-key natural gas system. ADNR states, "Several communities in Alaska have benefited from local energy development with low-cost or free energy supplies from nearby development." Where, other than Valdez, Kenai, and Barrow has this occurred? There is no rural Alaska place that has gotten cheaper energy as a result of an exploration	An exploration license does not guarantee development of natural gas resources; however, the gas potential in the Holitna Basin is unknown until exploration occurs. If commercial quantities of natural gas are located, local communities and villages may benefit from a low-cost energy supply. The village of Nuiqsut has also benefited from local energy development.

	license.	
48.	The finding is biased – it goes into great detail on the economic benefits of gas development but fails to fully discuss environmental damages. In Appendix A, ADNR states, "Development of the project may produce environmental benefits in the form of cleaner air to local residents as well as high-paying jobs and new business opportunities." How can a gas field in a currently pristine environment cause cleaner air?	If commercial quantities of natural gas are located, the air quality impacts associated with diesel-based heating and power generation for local communities and villages may be reduced. See Chapter Five for more discussion on the reasonably foreseeable negative effects of the project on air quality.
49.	There is a very real risk that the applicant will pull out of the region without doing adequate restoration. The bonds required are laughably inadequate. Please require additional bonds be posted.	See response to Common Issue 5.
50.	Will the applicant compensate villages for infrastructure and other necessary improvements?	Since the likelihood of new developments is unknown at this time, it is not possible to predict the impact on community services. However, it is unlikely that villages would be required to pay for improvements associated with the project.
51.	What indication does ADNR have that the applicant will perform actual exploration work if this license is issued? Does the company have any assets, expertise, or experience?	The work commitment and bonding required by the exploration license are intended to demonstrate the licensee's serious intentions to explore the license area. The discussion of exploration licensing in Chapter One addresses incentives for the performance of the exploration. As for company assets and experience, see response 16.
52.	Are any of the lands covered by the exploration license split-estate lands?	No, the state owns both the surface and subsurface of the license area. See Chapter Two for a map of the exploration license area.
53.	What is the authority for a gas only license? What does that mean? If oil is discovered, would the applicant have any right to it? Could another company apply for an oil lease here, on top of the gas only license?	AS 38.05.035 and 38.05.131-134 govern exploration licenses. See Chapter One for a detailed discussion. See also response 30. Although unlikely, a remote possibility of finding oil exists. If this were to occur, the licensee, who would not have any right to the oil, must shut down operations and contact DO&G. At that time, DO&G would undergo the best interest finding process for oil and gas development in the Holitna Basin. Alaska statutes provide for an oil and gas exploration license and a gas only exploration license; there is no

		statutory authority for an oil only exploration license.
54.	ADNR did a great job of explaining the applicable oil and gas regulations but didn't explain what impact issuance of an exploration license would have on future regulatory phases. What does it mean that the applicant would have a right to explore for and develop gas? If future public comment reveals strong opposition to a plan of operations, would the existence of this exploration license have any bearing on ADNR's decision? Would ADNR have the authority to deny a plan of operations based on local opposition or environmental concerns?	See response 53. ADNR has the authority to withhold approval of a plan of operations if the applicant does not comply with all lease terms, mitigation measures, and stipulations identified as appropriate during the review and public comment period.
55.	How many man hours and dollars do you expect to be available within OHMP, ADF&G, and DEC for oversight of this project?	This is a multiphase project. The exploration, development, and production phases, if they occur, will undergo detailed evaluations as specific activities are proposed at later stages of the project. ADNR is adequately funded to carry out necessary oversight functions. Funding and staffing levels of regulatory agencies are determined by the Alaska State Legislature and the Governor.
56.	Would the mitigation measures be enforced? If the applicant were theoretically to refuse to implement a mitigation measure, what would be the result?	See response 54. The commissioner may terminate the license for the licensee's failure to comply with any of the license provisions, including mitigation measures, statutes, regulations, or permit stipulations.
57.	Existing regulations are inadequate to deal with CBM. The finding states that standards similar to those developed in 2004 for CBM development within the Matanuska-Susitna Borough are included in the mitigation measures. But mitigation measures aren't enforceable like regulations, similar standards aren't as effective as those in the Mat-Su, and future permitting will not offer the same level of protection as enforceable regulations.	See response 54. Until exploration occurs, it is impossible to predict if production will take place and what impacts will occur. Mitigation measures prepared as part of the best interest finding process become terms of the license when it is awarded, and compliance is mandatory. The Matanuska-Susitna Borough standards process was not intended as a substitute for the best interest finding process, which must assess the specific location for which an application has been received. The mitigation measures attached to this exploration license are comprehensive and reflective of the years of cooperative work between ADNR and state and federal fish and wildlife biologists.

Chaliak, Sophie: Letter of September 30, 2005		
58.	I oppose the Holitna Basin drilling because we will be affected greatly physically, emotionally, culturally, environmentally, families, subsistence and many more. If this drilling happens I know there will be many disappointments health-wise, land, water, air, animals, fish, vegetation will be affected and we will lose our subsistence.	Opposition noted. See responses to Common Issues 1, 2 and 3.

Fairbanks, Grant: Bethel Meeting, September 28, 2005		
59.	Ninety-nine percent of all known published research shows that the potential for a discovery in the license area is low to nil. The permit area is located in the most important subsistence hunting and fishing watershed in the United States and the largest spawning grounds of the Kuskokwim salmon. The royalties and license fees are expected to have an insignificant effect on overall state revenues and will even cost the state money. We hear and read of potential benefits, highest and best use, and mitigating measures but we don't trust the state government. Are our fish and game resources being adequately protected? The state and federal oversight agencies are not capable of fulfilling their regulatory responsibilities because of funding cuts and the present political climate.	It is true that the petroleum potential is unknown until exploration occurs. Mitigation measures, together with evaluation and approval authority for all plans of operation, will provide sufficient environmental protection. See also responses to Common Issues 1 and 2. As for oversight and monitoring, ADNR will enforce all mitigation measures and permit stipulations.
60.	The official notice in the newspaper stated that a lease would only be issued if "a discovery of a local source of natural gas would benefit local resident."	The official public notice issued by ADNR on August 1, 2005, stated: "Before this offering can take place, the commissioner of DNR is required to make a final written finding that the offering is in the best interests of the state."
61.	It is better for the Holitna to be the storehouse for thousands of users; it is the highest and best use to have the river do what it has been doing for thousands of years than for the state to get a check for $26,779, less the hundreds of thousands of dollars	A cost benefit analysis is not required prior to determine if an exploration license is in the state's best interest. AS 38.05.035(g) lists the topics that must be considered and discussed in best interest findings (see Chapter One).

	ADNR will spend on the permitting processes.	
62.	All work must be above the 100-year flood line because 75 percent of the permit area floods on a regular basis.	Flood hazards are discussed in Chapter Six. Portions of the license area may be subject to seasonal flooding. It is expected that the setbacks from water bodies identified in the mitigation measures (Chapter Seven) will mitigate much of the flood hazard of the license area. Plans of operation will be evaluated to ensure proper precautions are taken in areas of possible flooding and erosion prone areas (in accordance with Governor's Administrative Order 175).

Fredericks, Gladys: Sleetmute Meeting, September 26, 2005		
63.	No amount of money is going to replace the land we live on now. Whatever is contaminated to the land is going to come downstream and affect everybody else.	See Common Issues 1, 2, and 3.

Gilila, David, Sr., of Akiak: Bethel Meeting, September 28, 2005		
64.	I oppose the exploration within the Holitna area because the Kuskokwim River is a lifeline for species of animals and fish. It's just like my blood, your blood. And the land is the body of that life bloodline, just like your body. When you take a portion of your skin, it takes a long time to heal. It's the same thing with the land, but unlike the skin, the land takes longer.	Opposition noted. See Common Issues 1, 2, and 3.
65.	Although they say the state will benefit, I am part of that state and I am not going to benefit. If something happened to the exploration – like they accidentally spilled some chemical on the river – would the company or the state give me food or money for me to survive? The governments don't even put a monetary figure on subsistence.	DO&G must balance many interests and concerns in determining whether an activity is in the state's best interest. See response to Common Issue 5.
66.	From what I understand, this company is from another country, which makes it even more dangerous because the company probably won't be accountable for any accidents that	All lessees must comply with terms of the license, including mitigation measures, as well as all other local, state, and federal regulatory requirements, whether they are U.S. or foreign companies.

	happen. Entities that are funded by the federal or state governments always leave a mess behind – take the old airport across from Bethel or the old WWII sites.	See also response 16.

Gordon, Theodore: Red Devil Meeting, September 27, 2005		
67.	If the local villages are given the opportunity to get natural gas at a reasonable price then it should do nothing but benefit them. Plus, most people out here use liquid propane cook stoves, which are convertible to natural gas. A lot of the roads would remain on request of the villages. I think these drilling rigs are going to be in areas where very few people even go – you can only see them if you go up there, or by airplane.	Support noted. If commercial quantities of natural gas are located, the costs associated with heating and power generation for local villages and communities may be reduced. Mitigation Measure 9 requires the licensee to provide a portion of produced gas to local communities first.

Hill Enterprises, Henry Hill of Sleetmute: Letter of September 30, 2005		
68.	I support the license to explore the Holitna Basin for two reasons: 1) it will provide geological information, of which very little exists for this area; and 2) it will possibly provide a local energy source for the area. With the careful oversight of state, federal, and local agencies, as is the case of the North Slope production, the environmental issues can be addressed.	Support noted. Petroleum potential is unknown until exploration occurs. See also response 67.
69.	The environmental impact from drilling two test holes or seismic work will have a small or insignificant impact on this area if done in winter and located as far as possible from drainages to the Holitna and Hoholitna Rivers.	DO&G is confident the mitigation measures, coupled with evaluation and approval authority for all plans of operation, will ensure protection against harmful effects to the environment.

Hubbard, Susan of Sleetmute: Letter of September 26, 2005		
70.	Thank you for coming to Sleetmute and collecting comments. I am strongly opposed to CBM exploration.	Opposition noted.

71.	The Holitna River area is sensitive wildlife, fish, and migratory bird habitat and residents up and down the river depend on the resources.	Comment acknowledged.
72.	No baseline water study or environmental impact study has been completed, nor is it required. How will we know what impact CBM has had if the preliminary work has not been done?	See Common Issues 3 and 4, and response 46.
73.	CBM in the Lower 48 has been an environmental nightmare and I see nothing in the preliminary finding that shows that the state is doing anything differently here.	See response 57.
74.	The finding does not describe how the water will be contained prior to being reinjected. Mr. St. George has stated they will store it in holding ponds. This area is on a floodplain.	See response 13.
75.	There is a fairly major fault line running between Sleetmute and Stony River. A shift in this area could cause major damage to oil wells and/or pipeline.	Earthquakes and faults are discussed in Chapter Six. Additionally, the plan of operations will include an emergency preparedness and response plan for potential emergencies, including earthquakes, that may be associated with the operation of facilities (see Mitigation Measure A(1)(e) in Chapter Seven).
76.	Water must be treated prior to reinjection but the finding does not describe a method for treating the water or to what level it needs to be treated.	See response to Common Issue 3.
77.	Many of the substances used to fracture coal to release the methane contain compounds that are detrimental to the environment and carcinogenic to humans. I see no plan to ensure the health of the environment and the humans downriver from the area.	See response to Common Issue 2.
78.	Local residents have used this area for 10,000 years – we should not be in the generation that causes their subsistence way of life to come to an end.	See response to Common Issue 1.

Kasigluk Traditional Elders Council, Elizabeth Steven of Kasigluk: Letter of September 15, 2005		
79.	The Kasigluk Traditional Elders Council (KTEC) requests to see Senate Bill 312, including any lease applications that have not been granted.	SB 312 was introduced in the 2004 legislative session but did not pass. ADNR sent a copy of SB 312 to KTEC.
80.	The KTEC opposes any CBM shallow gas exploration and development, including drilling core holes, because the Holitna Basin is either sensitive or critical habitat for several species of wildlife, including moose, bear, furbearers, and migratory waterfowl, and the spawning habitat for salmon, sheefish, whitefish and other species.	Opposition noted. See response to Common Issue 2.
81.	Noise from pumps, compressors, hydraulic fracturing, and vehicles would contribute to the loss or fragmentation of habitat and affect wildlife behavior.	Noise is discussed in Chapter Five. Mitigation Measure A(1)(e) requires facilities to be designed and operated to minimize sight and sound impacts in areas of recreational and subsistence use and important wildlife habitat. Additionally, plans of operation approvals may include monitoring requirements to minimize potential noise and/or visual impacts to adjacent users, and ground disturbance. The monitoring requirements will be tailored to the specific situation and potential impacts.
82.	Public access would be blocked off for the safety of people not involved in CBM development. This would limit access to traditional subsistence hunting and fishing areas.	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. See Mitigation Measure A(2)(a) and A(5)(a). Additionally, development of the area could actually increase access for traditional users of the area's resources.

Kasigluk Traditional Elders Council, Lucy Kassel of Kasigluk: Letter of September 16, 2005		
83.	The Kasigluk Traditional Elders Council (KTEC) requests to see Senate Bill 312, including any lease applications that have not been granted.	See response 79.
84.	The KTEC opposes any CBM shallow gas exploration and development, including drilling core holes, because the Holitna Basin is either sensitive or	Opposition noted. See response to Common Issue 2.

	critical habitat for several species of wildlife, including moose, bear, furbearers, and migratory waterfowl, and the spawning habitat for salmon, sheefish, whitefish and other species.	
85.	Noise from pumps, compressors, hydraulic fracturing, and vehicles would contribute to the loss or fragmentation of habitat and affect wildlife behavior.	See response 81.
86.	Public access would be blocked off for the safety of people not involved in CBM development. This would limit access to traditional subsistence hunting and fishing areas.	See response 82.

Kernak, Douglas, of Tuntutuliak: Bethel Meeting, September 28, 2005		
87.	All of the villages were not equally noticed of this public comment.	See response to Common Issue 6.
88.	We live solely on subsistence lifestyles in the Kuskokwim River area.	Comment acknowledged.

Kuskokwim Native Association, Calvin Simeon of Aniak: Letter of September 29, 2005		
89.	The Kuskokwim Native Association (KNA) opposes issuing this exploration license because the license area is in the heart of the Lower Holitna Basin wetland complex and contains extremely important habitat for fish and wildlife. The area is used extensively for subsistence living, including hunting, fishing, trapping, and berry picking. The State of Alaska Kuskokwim Area Plan for State Lands (1988) states: "The emphasis of state land management in the Holitna management unit is protection of the fish and wildlife habitat, and support for continued subsistence, commercial and sport use of these resources." The proposed gas exploration and possible extraction is not compatible with this management	Opposition noted. See response to Common Issue 2.

	goal.	
90.	The preliminary best interest finding failed to sufficiently catalog and inventory the fish and wildlife that use the area, along with the unique habitats present in the area. KNA members state that the Big Lake and connecting creeks contain important habitat for northern pike, grayling, and anadromous whitefish; however, little scientific documentation of fish and wildlife populations has been done in the Holitna Basin. A thorough fish and wildlife inventory, at the expense of the applicant and using local hires, should be completed prior to any gas exploration in the area.	Chapter Three discusses and considers fish and wildlife populations and habitats, and meets the requirements of AS 38.05. DO&G consulted with OHMP and ADF&G in compiling the fish and wildlife information in this final finding.
91.	The preliminary best interest finding failed to consider the full impact of gas exploration and/or extraction on the winter wildlife populations, such as moose and caribou. Exploration activities will disturb the moose and caribou during a time when the animals are most vulnerable to predation and starvation.	The reasonably foreseeable effects of the project on moose and caribou, including winter wildlife populations, are considered and discussed in Chapter Five.
92.	Mitigation Measure 15, aimed at protecting brown bear, is unrealistic, unattainable and will likely provide little protection. There is only one ADF&G wildlife biologist in the Lower Holitna Basin – an area about the size of Washington State. It is unrealistic to think that he or she would be able to adequately inventory brown bear dens within the proposed license area.	Mitigation Measure A(2)(e) requires the licensee to consult with ADF&G to identify locations of *known* bear den sites. It does not require ADF&G to independently research the entire project area for bear den sites. If the licensee encounters a bear den not previously identified by ADF&G, the licensee must report it within 24 hours to the ADF&G, Division of Wildlife Conservation.
93.	Mitigation Measure 16, aimed at protecting moose and caribou in wintering areas, will likely be unenforceable due to the lack of funding and staffing resources. ADNR should include which entity is responsible for providing the necessary wildlife information, along with the funds required to gather the information.	The director will consult with ADF&G in determining important moose and caribou calving and wintering areas. See also response 55.
94.	Mitigation Measures 16 and 17, aimed	Mitigation measures provided in this finding are

	at protecting moose, caribou, and waterfowl, are too vague and leave too much discretion to the director of DO&G.	sufficient to protect important moose and caribou calving and wintering areas and important waterfowl habitat.
95.	The preliminary best interest finding failed to address the effects of transporting vehicles, equipment, and fuel needed for gas exploration or development. Vehicles, equipment, and fuel would likely be barged from Bethel to Sleetmute, increasing barging activity on an already busy river. Additionally, transporting these items may result in spills in either the Holitna Basin or the main stem of the Kuskokwim River. These need to be addressed as potential impacts to water quality and fish and wildlife.	See responses 32 and 34.
96.	It is unacceptable to allow for surface release of wastewater authorized by a state permit. All wastewater should be reinjected in the aquifer from which it came.	See response to Common Issue 3.
97.	The preliminary best interest finding failed to mention or suggest protection of aquifers or natural hydrological processes, nor does it suggest that aquifers and natural hydrological processes be studied prior to gas development. Little is known of the hydrology of the Holitna Basin, in particular the connectivity between aquifer layers. A basic understanding of the hydrology should be obtained in the exploration phase and should be available to the public.	See response to Common Issue 4.
98.	There is no insurance of accountability – Holitna Energy Company is a small company with little operational history, yet it has the potential to cause extensive, expensive, and severe environmental damage. The state should require a bond in the amount necessary to perform any cleanup or mitigation operations, should a large spill or other such incident occur.	See response to Common Issue 5.

Kuskokwim River Salmon Management Group, Bev Hoffman, LaMont Albertson, and Greg Roczicka of Bethel: Letter of August 1, 2005		
99.	While the Kuskokwim River Salmon Management Group (KRSMG) does not support or oppose any exploration for gas in the Holitna Basin, it is obligated to ensure that the natural resources that allow the area to utilize the fisheries not be compromised. Because actions taken upriver will influence downriver fisheries, the KRSMG urges ADNR to conduct hearings in Bethel and other downriver communities.	ADNR held public meetings in Aniak and Sleetmute on September 26, 2005, Crooked Creek and Red Devil on September 27, and Bethel on September 28. Additionally, the meeting in Bethel was scheduled to coincide with a regional watershed meeting, to facilitate attendance by residents of downriver communities. See also response 1.

Kuskokwim River Salmon Management Group, Bev Hoffman and Greg Roczicka of Bethel: Letter of September 28, 2005		
100.	The Kuskokwim River Salmon Management Group (KRSMG) opposes the granting of a lease at this time unless or until it can be assured that water quality and quantity will not be affected. Studies have established that 25 percent of the Kuskokwim River chinook salmon come from the Holitna River Basin and perhaps as much as 50 percent of the sockeye salmon entering the Kuskokwim River originate in the Holitna River Basin. These sockeye may be unique in that they spawn and rear in river environments – most sockeye are dependent on lake systems for their early life history. Subsistence users have harvested 80,000 chinook salmon annually – this represents 50 percent of the total statewide subsistence harvest of chinook salmon.	Opposition noted. This information has been incorporated into the final finding. See responses to Common Issues 1 and 2.

LAPP Resources Inc., David Lappi of Anchorage: Letter of September 30, 2005		
101.	I believe it is in the state's best interest to issue this exploration license. At least two major mining operations in the region will require large amounts of energy. Additionally, resource	Support noted. Gas development in the proposed license area could provide a cost-effective energy source for other projects. An exploration license may also result in new employment opportunities in the gas industry, service, transportation, utilities, and retail

	development is one of the few business opportunities available in rural Alaska to provide employment, educational opportunities, and the desire for education.	sectors of the local economy. See also response 34. Under Mitigation Measures A(7)(a), (b), and (c), the licensee is encouraged to employ local and Alaska residents and contractors for work performed on the license area and must submit a proposal detailing the means by which the licensee will comply with this measure.
102.	From an environmental point of view, natural gas development is by far preferable to the current practice of hauling diesel fuel and home heating oil for use in electrical generation and space heating in Bush Alaska. Village storage tank farms are expensive and prone to fuel spills. If natural gas were more widely used, some of these spills could be prevented. Additionally, natural gas is a cleaner burning fuel than diesel.	Comment noted.

Luchsinger, Craig: Aniak Meeting, September 26, 2005		
103.	How are we to be assured that the long-term impacts of this project will be taken care of?	See response to Common Issue 5.
104.	Is this an American company or a multinational?	All lessees must comply with terms of the license, including mitigation measures, as well as all other local, state, and federal regulatory requirements, whether they are U.S. or foreign companies.

Maynard, Jill, of Bethel: Letter of September 29, 2005		
105.	I am opposed to the proposed exploration and development of CBM shallow gas exploration in the Holitna Basin. The Holitna Basin is a key area of subsistence practices of the people of the Yukon-Kuskokwim Delta, which includes villages in the exploration license area and those located upriver and downriver to the mouth.	Opposition noted. See response to Common Issue 1.
106.	CBM waste is exempt from being regulated as hazardous waste.	ADEC regulates waste disposal. Alaska does not have a hazardous waste program, so federal hazardous waste regulations apply (see 18 AAC 62.020). AS 46.03.900(9) defines hazardous wastes as “a waste or combination of wastes that because of quantity,

		concentration, or physical, chemical, or infectious characteristics may (A) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly managed, treated, stored, transported, or disposed of." Chapter One provides information about regulatory authorities
107.	Although not legislated as a critical habitat area, the Holitna Basin was determined by ADF&G to be a sensitive and/or critical habitat for several species.	See response to Common Issue 2.
108.	After reviewing the document I am unable to find any evidence where the positive effects will outweigh the negative and be in the best interest of the state. The state is spending more going through the permitting process than it will receive from the permit itself ($26,779).	See response 11.

McFarland, Cole, of Palm Desert, Calif.: Letter of September 20, 2005		
109.	I was impressed with the thoroughness with which the division addressed the environmental and other nontechnical issues. Location of a commercial natural gas resource in the basin could be key to development of local industry that could provide employment and hopefully stem the exodus of young people from the area.	Support noted. See response 101.

Morgan, Herman: Aniak Meeting, September 26, 2005		
110.	I am concerned about CBM dewatering – worried about contamination of the Holitna Basin. The basin floods in springtime. The water could damage the resource, as well as the people who eat the fish.	See responses to Common Issues 1, 2 and 3.

Morgan, Wayne: Aniak Meeting, September 26, 2005		
111.	How does the state have requirements	See response to Common Issue 5 and response 16.

	of the lessee? How much experience does the lessee have in doing something like this? The state will be responsible for damages to the resources, but we have no control over it because you have to trust the person doing the drilling. How do you know the quality of work from the lessee? You don't know. We don't want to be a testing ground for any new company to come here new to test.	

Native Village of Nunapitchuk, Zechariah Chaliak of Nunapitchuk: Letter of September 26, 2005		
112.	The Nunapitchuk IRA Council opposes any CBM/shallow gas exploration and development in the Holitna Basin and anywhere else in the Kuskokwim watershed. A large amount of contaminated water will be dispersed, thereby creating the chance of wiping out the subsistence salmon stock and other whitefish species. Pumping contaminated water back into the ground will be expensive and will contaminate other wells.	Opposition noted. See responses to Common Issues 1 and 3.

Nick, Robert: Bethel Meeting, September 28, 2005		
113.	I am opposed to the proposed permit because I am concerned about the future abundance of the chinook salmon and chum salmon.	Opposition noted. See responses to Common Issues 1 and 2.

Office of Habitat Management and Permitting, Robert McLean of Fairbanks: Letter of September 28, 2005		
114.	The ADNR Office of Habitat Management and Permitting (OHMP) consulted with the Alaska Department of Fish and Game Divisions of Commercial Fisheries, Sport Fish, Subsistence, and Wildlife Conservation and submitted consolidated comments. OHMP recommends additions and modifications to Chapters One and	All of the additions and modifications have been incorporated into the final best interest finding.

	Seven of the preliminary best interest finding.	
115.	In Appendix A, Summary of Comments and Responses, of the preliminary best interest finding, ADNR did not mention OHMP's comments submitted on July 30, 2003, and December 20, 2004.	Comments received from OHMP in July 2003 and December 2004 were incorporated in the preliminary best interest finding and referenced accordingly in Appendix F, References. The omission in Appendix A of the preliminary finding was inadvertent.

Oscar, John, of Mekoryuk: Bethel Meeting. September 28, 2005		
116.	Since the current administration has been in office, there have been dramatic changes to the permitting process for development. HB 191, passed in 2003, provides for speedy, streamlined processes, reduced public process, and concentrates power in the ADNR. What guarantee or due deference does this provide to the general public? Changes to the law will result in increased impacts to resources; for example, the requirement to maintain or enhance fish habitats has been removed from the habitat standard.	See Common Issue 7.
117.	Under ADNR's interpretation of the new subsistence regulations, ADNR may only establish subsistence policy that allows or disallows use – it may not address access to subsistence resources, establish priority use or address the level of need.	ADNR does not regulate subsistence use; rather the Division of Subsistence within ADF&G is charged with regulating subsistence hunting and fishing. Mitigation Measures A(3)(a) and A(5)(a) address subsistence and access.
118.	The OHMP has only two statutes and no regulations – habitat other than fish streams is not adequately protected. ADNR's interpretation of the state habitat standards would limit consideration of projects in most habitats to nonliving matters, such as water quality, quantity, and nutrients.	See Chapter One for more discussion on OHMP and ADF&G's regulatory authority as it pertains to oil and gas exploration and development.
119.	In 2003, HB 69 removed CBM project review, even though there may be considerable effects to the uses and resources. In 2003 HB 191 removed matters regulated by ADEC from public reviews. For example, because ADEC regulates prevention of and	See response to Common Issue 7, and responses 23, 30, 31, and 116.

	response to oil spills, consistency reviews may not address any aspects of a project related to potential spills. HB 191 also required more projects be added to the A and B lists. And HB 86 eliminates the ability of citizens or tribal organizations to appeal consistency determinations in court. All of these actions diminish local control and concentrate power in ADNR. Once an applicant applies for a permit, there is a guarantee that the applicant will get that permit.	
120.	HB 191 or 86 or one of those bills requires the one challenging the permit to provide scientific documentation and proven assessment by mapping, testimonies, and written knowledge to challenge the permit in court. Otherwise the lawsuit is frivolous.	See response to Common Issue 7, and responses 116 and 119.
121.	Mitigation is less and usually no adequate guarantee for no harm in the project area. There is only one paragraph in the mitigation measures dedicated to subsistence. The performance in the past in the way the state has treated the remote communities has not been at all sympathetic.	See response to Common Issue 1.

Patton, Eva of Bethel: Letter of September 30, 2005		
122.	I am opposed to any exploration or mining development in the Holitna Basin. The area is of extraordinary importance to migratory waterfowl, numerous fish species, and wildlife. Evidence from ADF&G shows that nearly 25 percent of tagged salmon return to this drainage to spawn. Any impact to the salmon of the river will impact the people who depend on these fish for basic survival. Impacts could come from a spill during increased barge traffic on the river, leaks from drilling oils, lowering the water table, or through reinjection. Other fish species are important as	Opposition noted. See responses to Common Issues 1 and 2.

	well, but Western science has very little data on these species, such as whitefish, sheefish, burbot, and blackfish.	
123.	See scientific literature by respected river ecologist Bob Naiman on the connectivity between subsurface water and groundwater. How do you propose to determine that the reinjection waters will not be communicating at all with any areas of the Holitna River?	See response to Common Issue 3.
124.	The exploration license has the potential to detrimentally impact all communities on the Kuskokwim River. All people from all the communities must have a chance to understand what is happening and to comment. ADNR did not provide reasonable effort to reach communities downriver of Aniak, many of which do not have access to e-mail, regular news, fax or other avenues of communication. ADNR did not put forth information or hold hearings in the first and Native language of the region – many of the people who would be most impacted by this project do not speak English.	See response to Common Issue 1, and responses 2 and 8.

Pavilla, Nick: Bethel Meeting, September 28, 2005		
125.	[*Testimony translated from Yup'ik*] He feels this issue is so important he wanted to speak in his Native language. It is very important to keep our rivers clean of pollutants and keep our lands also clean. He does not support the exploration license.	Opposition noted. See response to Common Issue 1.
126.	Since the disasters in the Gulf Coast, one of the things that hurt the people is the pollution to the drinking water. That's one of the reasons he does not support the exploration. He would like to keep the waters in which the salmon migrate and the other fish depend, clean. It is for our future descendants, our people that will be	See responses to Common Issues 1 and 3.

	living on this land after us, that we have to think about.	

Pere, Guy: Red Devil Meeting, September 27, 2005		
127.	From an environmental standpoint, the footprint of a drill rig is not that significant. And you won't have to worry about oil spills. With pipelines, I am sure there is a way to shut it off. Compare that with barging – how many gallons of oil go up the Kuskokwim River? It is a very shallow river, the sandbars move and the barges are always running aground. Your potential for an oil spill that could have a catastrophic effect on the fishery, it's almost a given that you are going to have an oil spill. To me this is a much better option. I see it as a cleaner alternative to diesel.	Support noted. Mitigation measures, along with evaluation and approval authority for all plans of operation, will protect the environment. Additionally, gas may pose less environmental risk than diesel.

Pitts, Rodger: Red Devil Meeting, September 27, 2005		
128.	My concerns are mainly with the environment, such that the exploration companies be required to place reasonable bond in order to have access to the land. As long as the companies understand that they are going to have to follow safe, clean environment policies, that they aren't going to be able to leave behind toxic waste of any kind, that damage to the environment be kept to a minimum, I see no problem with exploration.	See response to Common Issue 5.

Pleasant, Susan, of Tuntutuliak: Letter of September 30, 2005		
129.	I am opposed to drilling anywhere near the Kuskokwim River because of the potential to harm the fish. The fish are very important to the people who live in the area – they are the ones that will be affected, not the developer.	Opposition noted. See responses to Common Issues 1 and 2.

Roczicka, Greg: Bethel Meeting, September 28, 2005

130.	How do you come to the determination that this is in the state's best interest? The dollar return is such an insignificant amount in comparison to the billions of dollars that come in throughout the state. Benefits to local communities? What do you consider local communities? The four villages around there will have to switch over to take advantage of the gas. How indeed does the state benefit at a dollar per year per acre coming out to $27,000? I'm not seeing any benefit to the state – I'm seeing benefit, perhaps, to the desires of just this person alone. It's actually becoming a tax burden to the state, and potentially the rest of the people that live in the drainage. The risk factors of damage to the habitat and water quality, although you do have mitigating measures in place, far outweigh any potential benefits.	See response 11. See Chapter Four for a full description of communities in the project vicinity.
131.	What is the difference between this gas lease, as far as marketability and potential for resources extraction, compared to that in the Mat-Su? As I understand, the Mat-Su was determined as a much higher return and yet the leases have been revoked in that area. The primary reason for revoking the leases was aesthetics, not the resource concerns we have here. I'm sure you offered many of the same mitigation measures you're offering here. What makes our concerns of a lesser value than those?	ADNR does not weigh projects in different parts of the state against each other; rather ADNR is required to determine whether the proposed exploration license is in the best interest of the state. See response to Common Issue 1.

Rush, Christian: Sleetmute Meeting, September 26, 2005		
132.	Methane gas is combustible so what is the plan for fire hazards?	Plans of operation include emergency preparedness and response plans for potential emergencies, including fires, that may be associated with the operation of facilities.

Rush, James: Sleetmute Meeting, September 26, 2005		
133.	The sense I get from the company is that they're apprehensive about, what they're afraid about is 'what if they	DO&G has provided a preliminary assessment of the area's petroleum potential in Chapter Two.

	find gas.' Why is this thing so important, beyond the scientific data that is going to be gathered for a very specific locale?	

Sleetmute Traditional Council, Pete Mellick of Sleetmute: Letter of September 29, 2005		
134.	The Sleetmute Traditional Council (STC) has opposed all CBM exploration and development in the Holitna Basin for the last three years. This type of development does not serve the best interests of the state, nor those of the local communities.	Opposition noted.
135.	Although it is not designated by the Legislature as a critical habitat area, ADF&G biologists have identified the Holitna Basin as critical habitat for several species of wildlife, spawning grounds for several species of fish, and nesting for several species of waterfowl. The upper Kuskokwim is the only region in Alaska where subsistence plays a larger role in the local economy than cash.	See responses to Common Issues 1 and 2.
136.	While ADNR and the developer have assured the public that protection of the environment would be the first priority, the STC believes otherwise. No baseline water study or hydrological study is required, due to HB 394, passed in 1996.	See responses to Common Issues 3 and 4 and response 23.
137.	The intent of best interest findings used to be "if development benefits local communities" – now it is "if it is in the best interest of the state."	See Common Issue 7.
138.	HB 69, passed in 2002, exempted CBM waste from solid waste and pollution laws that other mining and oil and gas development must follow. CBM waste is exempt from being regulated as hazardous waste.	See Common Issue 7 and responses 23 and 106.
139.	State law preempts local law – borough, city, and tribal.	See Common Issue 7 and response 23.
140.	In spring of 2002, the governor moved	See Common Issue 7 and response 23.

	the OHMP from ADF&G to ADNR.	
141.	No environmental impact statement or environmental assessment is required.	The National Environmental Policy Act (NEPA) of 1969 is a federal procedural law that requires an environmental assessment or environmental impact statement for all major federal actions. The state is not required to comply with NEPA when offering an exploration license; rather AS 38.05.035(g) lists the topics that must be considered and discussed in the best interest finding analysis (see Chapter One). Statutory requirements have been followed for this finding.
142.	Reinjection of produced water is not required and ADNR may authorize disposal into streams. The developer has stated that water will be reinjected, but it is not required.	See response to Common Issue 3.
143.	Regional and local village corporations do not represent their shareholders on this issue.	Comment acknowledged.
144.	CBM is not the preferred energy source of the locals, as claimed by the president of Holitna Energy Company.	Comment acknowledged.
145.	Any short-term benefits (cheap power and temporary jobs) do not offset the long-term impacts to the environment.	A cost benefit analysis is not required prior to offering an exploration license. Many interests and concerns must be balanced in determining whether an activity is in the state's best interest.
146.	Please incorporate by reference all comments sent in by STC and any other entities or individuals regarding CBM gas applications (ADLs 390390-390394 and 390605, and land use permit MLUP/AK03-7).	See response 9.

Smith, Fred: Bethel Meeting, September 28, 2005		
147.	I don't support this license because of the potential impact on fish and game resources and the potential impact on the water supply.	Opposition noted. See responses to Common Issues 1, 2 and 3.
148.	The applicant has not presented this community with any opportunity to understand the project or provide input.	See Common Issue 6.
149.	There are no studies that support the regulatory safeguards that ADNR relies on, such as the escapement of drill fluids into the river systems and	The mitigation measures were developed after considering terms imposed on earlier exploration activities, competitive lease sales, and comments, information submitted by the public, local governments,

	the escapement of drill-generated water into the systems.	environmental organizations, and the regulations and authorities of other federal, state, and local agencies, including AOGCC, ADEC, OHMP, and ADF&G.

Steele, Carey, of Nunapitchuk: Letter of September 30, 2005		
150.	I oppose any CBM/shallow gas exploration and development in the Holitna Basin and anywhere else in the Kuskokwim watershed. The basin is a sensitive subsistence area for villages – the upper Kuskokwim is the only area in the state where subsistence has a larger role in the rural economy than cash. The basin is a critical and sensitive habitat for several species of wildlife.	Opposition noted. See responses to Common Issues 1 and 2.
151.	CBM waste is exempt from being regulated as hazardous waste but the waste often contains heavy metals (such as arsenic and mercury) as well as naturally radioactive materials. CBM development also uses cancer-causing substances (benzene), diesel fuel, and other chemicals during different stages. Additionally, produced water, pumped onto the surface, will destroy vegetation due to the high salt content.	See response to Common Issues 3 and 7, and response 106.
152.	Noise and the increase in recreational use of the area would affect wildlife behavior.	See response 81.

Thomas, Bedusha: Crooked Creek Meeting, September 27, 2005		
153.	How are you going to assure us that our fish and game won't be affected?	See responses to Common Issues 1 and 2.

Thomas, Evelyn: Crooked Creek Meeting, September 27, 2005		
154.	We don't really know a lot about methane gas exploration or gas exploration. I've heard both good and bad about methane gas; in Montana we talked to people who had no economic benefit but were not bothered by it. If you do this, you be very careful. That they are monitored	Mitigation measures, along with evaluation and approval authority for all plans of operation, will adequately protect the environment. As for reclamation, see response to Common Issue 5.

	and whatever chemicals they use are contained to the best of their ability. It isn't *if* an accident happens out here, it's when. And what you are going to do to minimize the damage because it will happen. I would like to think that the EPA in this state has enough expertise to make sure that any damage is minimal. I don't oppose the project but when they are finished with it, I'd like to see them clean it up completely. I intend, with the other development out here, to make use of ADNR and EPA to make sure that whatever development is done in this area is done in a responsible, careful manner. These resources are not renewable and when they are gone, we'll need to go back to eating off the land.	
155.	We need economic development. But ADNR needs to be careful and explain exactly what is going to happen. I think they've done that many times.	Comment acknowledged.

Tobeluk, Jacob: Nunapitchuk: Letter of September 29, 2005		
156.	All of the people of Nunapitchuk depend on the Kuskokwim River and travel hundreds of miles round trip to harvest fish. If something should happen that affects this environment and the people, the big companies will not give a helping hand. We need to think about our future generations – in Yup'ik "Umyuaqnarqaput kinguliamta ciunerkaat."	See response to Common Issue 1.
157.	I did not like the way the meeting in Bethel was held. There was no translator for the elderly people attending and the presenter did not have answers to the questions that were asked. ADNR should postpone all activities and start over and go to villages ready with answers and translators.	See response 2.

U.S. Department of Interior, Bureau of Indian Affairs, Valerie Thomas of Juneau: Letter of September 30, 2005		
158.	The Sleetmute Traditional Council has asked for the Bureau of Indian Affairs' (BIA) technical assistance in opposing the Holitna gas only exploration license. CBM extraction is incompatible and potentially ecologically devastating for the Kuskokwim Watershed's incomparable biotic resources and imperative subsistence and regional ecosystem functions. The BIA is concerned about the introduction of produced water, cuttings (tailings), sludge and other material into the watershed because of their concentrations of heavy metals and other hazardous materials that pose threats to birds, fish, and mammals that are depended upon for subsistence throughout the Kuskokwim watershed.	See responses to Common Issues 1, 2, and 3.
159.	By-product methane seeps may pose a fire hazard.	See response 132.
160.	The BIA is concerned about public access limitations for subsistence that may be imposed as a result of CBM activities. Also, the BIA is concerned about increased pressure on the subsistence resources due to increased access on new trails and roads in the area.	See response to Common Issue 1 and response 82.
161.	Prior comments were not addressed.	ADNR is not in receipt of prior comments submitted by the BIA for this project.

Williams, Annie Lou, of Kalskag: Bethel Meeting, September 28, 2005		
162.	I oppose this project. We must speak for the things that have a silent voice. And the silent voice is the Kuskokwim River, the fish that are there, the animals, the berries, the plants, the vegetation, the trees, our young children, the unborn, and for other people and for generations to come. We, as Native people, are always	Opposition noted. See response to Common Issue 1.

	defending ourselves, our land, our waters, our animals, our homes. I would like to see our people in the future seven generations continue to live on our lands without too much defensiveness from the state. And we hope that these people that live in the later generations are not living in contaminated areas – they should be able to drink clean water, breath clean air, and come and go on nice land.	

Unknown: Sleetmute Meeting, September 26, 2005		
163.	My concern is that we are going to get run over by this. The project will happen no matter what, but my concern is for my kids, my grandkids, my great grandkids.	See response to Common Issue 1.

Unknown: Bethel Meeting, September 28, 2005		
164.	My concern relates to anadromous streams and whether there will be some drilling in the drainage. It sounds like there will be seismic testing in the wintertime within one-quarter mile of the drainage but the license area crosses over the Holitna drainage, including very important spawning streams like Basket Creek.	See Chapter Five and the licensee advisories in Chapter Seven for more information on work in anadromous streams.

Appendix B: Laws and Regulations Pertaining to Oil and Gas Exploration, Development, Production, and Transportation

Alaska Statutes (AS) and Administrative Code (AAC) Sections

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.

ADNR Division of Oil and Gas (DO&G)

AS 38.05.035(a)(9)(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 38.05.132	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 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

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.

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 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	Pipeline right-of-way leasing regulations.
11 AAC 93.040 to 11 AAC 93.130	Requires water rights permit for appropriation of state waters for beneficial uses.
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.

ADNR Office of Habitat Management and Permitting

AS 41.14.840	Requires permit from ADNR prior to obstruction of fish passage.

AS 41.14.870	Provides for protection of anadromous fish and game in connection with construction or work in beds of specified waterbodies and calls for approval of plans by deputy commissioner, ADNR, for construction of hydraulic project or any use, diversion, obstruction, change, or pollution of these waterbodies.
11 AAC 195.010	Atlas and catalog of waters important for spawning, rearing, or migration of anadromous fish. Permit application procedures.

ADNR Office of Project Management and Permitting

6 AAC 80.070(b)(3)	Requires that energy facilities in coastal areas be consolidated to extent feasible and prudent.
6 AAC 80.070(b)(10) to 6 AAC 80.070(b)(12)	Requires that energy facilities in coastal areas be sited to extent feasible and prudent where development will necessitate minimal site clearing, dredging, and construction in productive habitats, to minimize risk of oil spills in or other contamination of productive or vulnerable habitats, and to allow for free passage and movement of fish and wildlife.
6 AAC 80.130(c)(3)	Requires that wetlands and tideflats be managed to assure adequate water flow and to avoid adverse effects on natural drainage patterns, destruction of important habitat, and discharge of toxic substances.

Alaska Department of Fish and Game (ADF&G)

AS 16.20	Management of legislatively designated game refuges, sanctuaries, and critical habitat areas.
AS 16.20.060, AS 16.20.094, 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	Require measures for continued conservation, protection, restoration, and propagation of endangered fish and wildlife.

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 46.03.900(35)	Definition of waste.

AS 46.03.100	Standards and limitations for accumulation, storage, transportation, and disposal of solid or liquid waste.
20 AAC 25.005 to 20 AAC 25.570	Requires permit to drill, to help maintain regulatory control over drilling and completion activities in state.
20 AAC 25.140	Requires water-well authorization to allow abandoned oil and gas wells to be converted to freshwater wells and to assure freshwater source is not contaminated.

Alaska Department of Environmental Conservation

AS 46.03	Provides for environmental conservation including water and air pollution control and radiation and hazardous waste protection.
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)	Definition of waste.
AS 46.04.010 to AS 46.04.900	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 above-ground 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 above-ground storage facilities that have capacities of less than 5,000 bbl of crude oil or less than 10,000 bbl of noncrude oil.
18 AAC 70	Requires Certificate of Reasonable Assurance (Water Quality Certification) in order to protect state waters from becoming polluted. Assures that issuance of federal permit will not conflict with Alaska's water quality standards.
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 60.265	Requires proof of financial responsibility before permit for operation of hazardous waste disposal facility may be issued.

18 AAC 60.200	Requires solid waste disposal permit to control or eliminate detrimental health, environmental, and nuisance effects of improper solid waste disposal practices and to operate solid waste disposal facility.
18 AAC 60.430(a)(2)	General requirement for containment structures used for disposal of drilling wastes.
18 AAC 72	Requires wastewater disposal permit in order to prevent water pollution (and public health problems) due to unsafe wastewater disposal systems and practices.
18 AAC 75.305 to 18 AAC 75.395	Provides for oil and other hazardous substance pollution control, including oil discharge contingency plan.
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 and surge tanks.
18 AAC 75.080	Facility piping requirements for oil terminal, crude oil transmission pipeline, exploration, and production facilities.
AS 26.23.900(1)	Defines State Emergency Response Commission.

Federal Laws and Regulations

[CFR, Code of Federal Regulations; USC, United States Code]

Clean Water Act

33 USC §§ 1251 to 1387 — Water pollution controls

33 USC § 1344 — Army Corps of Engineers permit required to excavate, fill, alter, or otherwise modify course or condition of navigable or U.S. coastal waters and to discharge dredge-and-fill material

Environmental Protection Agency (EPA)-administered oil and other hazardous substance regulations

40 CFR § 109 — Criteria for oil removal contingency plans

40 CFR § 110 — Discharge of oil

40 CFR § 112 — Oil pollution prevention

40 CFR § 112.7 — Guidelines for implementing spill prevention, control, and countermeasures plan

40 CFR § 113(A) — Liability limits for small onshore storage facilities (oil)

40 CFR § 116 — Designation of hazardous substances

40 CFR § 117 — Determination of reportable quantities for hazardous substances

Coast Guard, Department of Homeland Security-administered regulations relevant to oil spills in navigable waters

33 CFR §§ 153 to 158

33 CFR § 153 — Reporting oil spills to Coast Guard, Department of Homeland Security

33 CFR §§ 155 to 156 — Vessels in oil transfer operations

EPA-administered water quality regulations

40 CFR § 121 — State certification of activities requiring federal license or permit

40 CFR § 136 — Test procedures for analysis of pollutants

EPA-administered National Pollutant Discharge Elimination System regulations

40 CFR § 122 — NPDES permit regulations

40 CFR § 125 — Criteria and standards for NPDES permits

40 CFR § 129 — Toxic pollutant effluent standards

40 CFR § 401 — General provisions of effluent guidelines and standards

40 CFR §§ 435 — Offshore oil and gas extraction point-source category

EPA-administered ocean dumping regulations

40 CFR §§ 220 to 225 and 227 to 228 — Ocean dumping regulations, permits, and criteria

EPA-administered materials discharge and disposal regulations

40 CFR § 230 — Discharge of dredged or fill material into navigable waters

40 CFR § 231 — Disposal site determination

Army Corps of Engineers-administered navigable waters regulations

33 CFR § 209 — Navigable waters

33 CFR §§ 320 to 327 and 330 — Permit program regulations

33 CFR § 323 — Discharge of dredge and fill

33 CFR §§ 328 and 329 — Definitions of waters

Fish and Wildlife Coordination Act

Clean Water Act § 404 — Permit applications

16 USC § 662(a) Allows comments on permit applications by EPA, National Marine Fisheries Service, U.S. Fish and Wildlife Service (USF&WS), and state agency that administers wildlife resources.

Comprehensive Environmental Response, Compensation, and Liability Act

42 USC §§ 9601 to 9675 — Environmental laws

EPA-administered oil and other hazardous substance pollution regulations

40 CFR § 300 — National Oil and Hazardous Substances Pollution Contingency Plan

Safe Drinking Water Act

42 USC § 300 (f) to (h)

EPA-administered underground injection regulations

40 CFR § 144 — Permit regulations for underground injection control program

40 CFR § 146 — Criteria and standards for underground injection control program

40 CFR § 147 — State underground injection control program

Solid Waste Disposal Act, as amended by Resource Conservation and Recovery Act

42 USC §§ 6901 to 6991

Clean Air Act

42 USC §§ 740l to 7661

Toxic Substances Control Act

15 USC §§ 2601 to 2655

National Environmental Policy Act (NEPA)

42 USC §§ 4321 to 4347

Council on Environmental Quality-administered NEPA-related regulations

40 CFR §§ 1500 to 1508 — Implement NEPA procedures

Endangered Species Act

16 USC §§ 1531 to 1543

USF&WS-administered threatened and endangered species regulations

50 CFR § 17 — Threatened and endangered wildlife and plant species

50 CFR § 402 — Interagency cooperation

Marine Protection, Research, and Sanctuaries Act

33 USC §§ 1401 to 1445

Marine Mammal Protection Act

16 USC §§ 1361 to 1407

Migratory Bird Treaty Act

16 USC §§ 703 to 712 and 715

National Historic Preservation Act

16 USC § 469 and 470

Leases and Permits on Restricted Properties

25 CFR § 162

Appendix C: Directional and Extended-Reach Drilling

Directional drilling is a drilling technique whereby a well is deliberately deviated from the vertical in order to reach a particular part of the reservoir. Directional drilling technology enables the driller to steer the drill stem and bit to a desired bottom hole location. Directional wells initially are drilled straight down to a predetermined depth and then gradually curved at one or more different points to penetrate one or more given target reservoirs. This specialized drilling usually is accomplished with the use of a fluid-driven downhole motor, which turns the drill bit (Gerding, 1986). Directional drilling also allows multiple production and injection wells to be drilled from a single surface location such as a gravel pad or offshore production platform, thus minimizing cost and the surface impact of oil and gas drilling, production, and transportation facilities (see Figure 5.3). It can be used to reach a target located beneath an environmentally sensitive area and may offer the most economical way to develop offshore oil fields from onshore facilities.

The limitations of directional drilling are primarily dependent upon maximum hole angle, rate of angle change, and torque or friction considerations. In directional drilling, it is now common for the horizontal displacement of the bottom hole location to be twice the total vertical depth (TVD) of the well. That is, a well with a vertical depth of 7,000 feet could have a bottom hole horizontal displacement of 14,000 feet from the drill site. However, in a shallower well, such as one in which a potential target is two miles away from the drill site but only one mile deep, directional drilling would be much more difficult, risky, and costly (Schmidt, 1994).

Direction drilling may be limited by the type of geology or rock through which drillers must drill in order to reach the desired target. Coal and shale deposits tend to expand or collapse the well bore and cause the drill string to get stuck. This is more likely to happen in wells that take longer to drill where the downhole formations are exposed to the drilling mud and drill string longer before well casing is cemented into the hole. Small subsurface faults are difficult to locate prior to drilling, and if the drill bit crosses a fault, the type of rock being drilled may suddenly change and a new geologic reference must be established. During this intermediate period in the drilling operation, the driller will not be sure if the desired geologic target is being drilled or could be intersected again (Schmidt, 1994). Stuck pipe can also occur in directional wells when the borehole becomes oval shaped from the drill pipe constantly laying on the downside part of the well bore. The pipe gets lodged in the groove cut on the bottom of the hole. The most common cause of hole collapse is the chemical difference between in-formation saltwater and the water in drilling mud. This is especially common when drilling through shale. Ions in the water in the mud have a tendency to transfer to the shale, the shale expands, and small sheets slough off into the hole, causing the pipe to get stuck (Gerding, 1986).

Subsurface collisions with neighboring wells can be problematic when drilling multiple boreholes from one surface location. A collision with a producing well could result in a dangerous situation. Anticollision planning begins with accurate surveys of the subject well and a complete set of plans for existing and proposed oil and gas wells (Schlumberger Anadrill, 1993).

Perhaps the greatest limitation on directional drilling is cost. For certain reservoirs, directional drilling technically may be possible but is not always economically feasible. Factors that may prohibit the use of directional drilling, such as the position of oil or gas deposits in the geologic structure relative to the drilling rig, the size and depth of the deposit, and the geology of the area, are all important elements that determine whether directional drilling is cost effective (Winfree, 1994).

The environment and the cost of multiple pads or locations are also considerations in determining the cost-effectiveness of directional drilling.

Horizontal drilling, a more specialized type of directional drilling, allows a single well bore at the surface to penetrate oil- or gas-bearing reservoir strata at angles that parallel or nearly parallel the dip of the strata. The well bore is then open and in communication with the reservoir over much longer distances. In development wells, this can greatly increase production rates of oil and gas or volumes of injected fluids (Winfree, 1994). Horizontal drilling may involve underbalanced drilling, coiled tubing, bit steering, continuous logging, multilateral horizontals, and horizontal completions. Lateral step-outs are directional wells that branch off a main borehole to access more of the subsurface. Conditions for successful horizontal wells include adequate prespud planning, reservoir descriptions, drillable strata that will not collapse, and careful cost control (PTTC, 1996).

Extended-Reach Drilling (ERD) has evolved from simple directional drilling to horizontal, lateral, and multilateral step-outs (see Figure E.1). ERD employs both directional and horizontal drilling techniques and has the ability to achieve horizontal well departures and total vertical depth-to-deviation ratios beyond the conventional experience in a particular field (Gerding, 1986). ERD can be defined in terms of reach/TVD (total vertical depth) ratios (Judzis et al., 1997). The definition of an ERD well depends on the results of existing drilling efforts in a particular oilfield (Gerding, 1986). Local ERD capability depends on the extent of experience within specific fields and with specific rigs and mud systems. “ERD wells drilled in specific fields and with specific rigs, equipment, personnel, project teams, etc. do not necessarily imply what may be readily achieved in other areas.” (Judzis et al., 1997).

Possible challenges to successful ERD include problematic movement of downhole drillstring and well casing, applying sufficient weight to the drill bit, buckling of well casing or drillstring, and running casing successfully to the bottom of the well. Drillstring tension may be a primary concern in vertical wells, but in ERD, drillstring torsion may be the limiting factor. Running normal-weight drill pipe to apply weight to the bit in ERD can lead to buckling of the drill pipe and rapid fatigue failure. Conventional drilling tools are prone to twist-off because of unanticipated failure under high torsional and tensile loads of an extended-reach well (JPT, 1994). Torque can be significantly reduced with the use of nonrotating drill pipe protectors (Payne et al., 1995). Advanced equipment for an ERD well may include wider diameter drill pipe, additional mud pumps, enhanced solids control, higher capacity top-drive motors, more generated power, and oil-based drilling fluids (Judzis et al., 1997).

ERD requires longer hole sections, which require longer drilling times; the result is increased exposure of destabilizing fluids to the well bore (JPT, 1994). Oil-based muds are superior to water-based muds in ERD (Payne et al., 1995). Water-based muds may not provide the inhibition, lubrication or confining support of oil-based muds (JPT, 1994).

Drillstring design for ERD involves: (1) determining expected loads; (2) selecting drillstring components; (3) verifying each component’s condition; (4) setting operating limits for the rig team; and (5) monitoring condition during drilling. Economic and related issues in drillstring planning include cost, availability, and logistics. Rig and logistics issues include storage space, setback space, accuracy of load indicators, pump pressure and volume capacity, and top-drive output torque. Drill hole issues include hole cleaning, hole stability, hydraulics, casing wear, and directional objectives (Judzis et al., 1997).

Figure C.1. Multilateral wellbore completions.

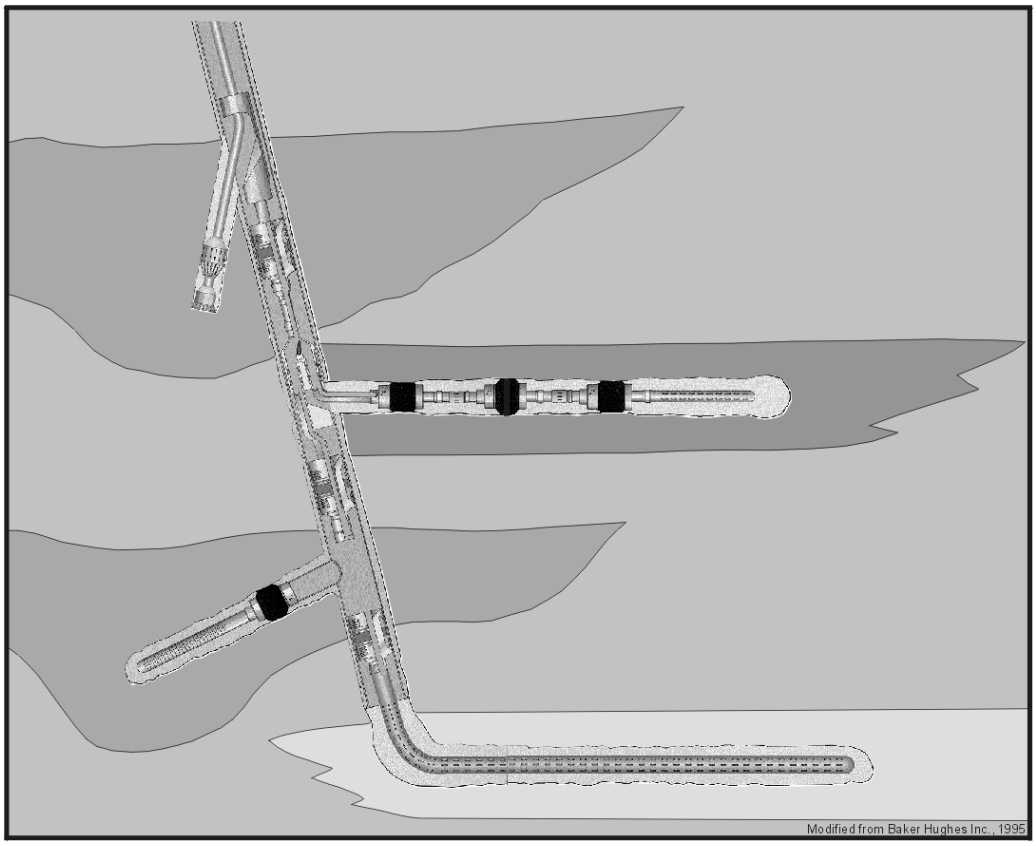
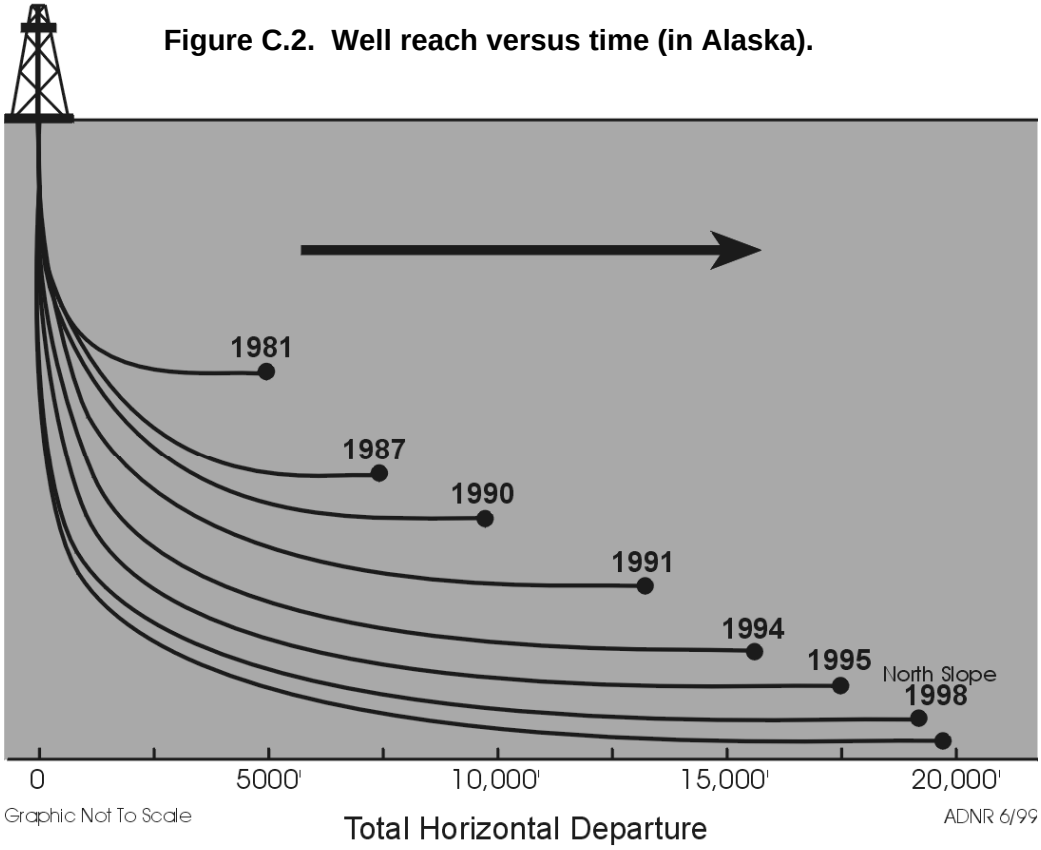


Figure C.2. Well reach versus time (in Alaska).



The working relationship between various components of a drill string must be analyzed carefully. Conventional drill stems are about 30 feet long and are made up of a bit, stabilizer, motor, a measurement-while-drilling (logging) tool, drill collars, more stabilizers, and jars. Typically there are more than 1,600 parts to a drill string in a 24,000-foot well. A modern drill string can be made up of hundreds of components from more than a dozen vendors. These components may not always perform as anticipated and may not meet operational demands of drilling an extended-reach well (JPT, 1994).

In a few cases, ERD technology has been used instead of platform installation off the coast of California, where wells are drilled from onshore locations to reach nearby offshore reserves. ERD has been instrumental in developing offshore reserves of the Sherwood reservoir under Poole Bay from shore at Wytch Farm, U.K. The original development plan called for the construction of a $260 million artificial island in the bay (JPT, 1994). ERD also has been used successfully in the North Sea, in the Gulf of Mexico, in the South China Sea, and in Alaska (Milne Point, Badami, Point McIntyre, Alpine, and Niakuk fields) (Judzis et al., 1997).

Although a 6.6-mile horizontal displacement was accomplished in 1999 at Cullen Norte 1 well in Argentina (Halliburton, 1999), horizontal displacements (departure from vertical) of 0.5 to 2 miles are typical. In October 1998, BP set a long-reach record for horizontal directional wells in the U.S. with a displacement of 19,804 feet in the Niakuk field (see Figure E.2). Despite its $6 million price, the well represents a cost saving over the other drilling alternatives, such as construction of an offshore artificial gravel island (AJC, 1996).

Exploration wells within the license area may be directionally drilled because of a lack of suitable surface locations directly overlying exploration targets. However, until specific sites and development scenarios are advanced and the specific conditions of drill sites are known, the applicability of directional drilling for oil and gas within the license area is unknown. It is anticipated that most development wells will be directionally drilled because of the cost savings realized in pad construction and required facilities.

Many surface use conflicts can be avoided through directional drilling and ERD. However, some reservoirs are located or sized such that directional drilling cannot eliminate all possible conflicts.

Appendix D: Coalbed Methane Wells

Coalbed methane (CBM) "pilot" projects are the method used to production-test a coal seam to determine if it can economically sustain CBM development. If the pilot project is successful, then a CBM development plan would be considered. CBM pilot projects usually involve four to five wells, with one well in the center and the other wells surrounding it. A development plan would involve a larger number of wells spread over a large area. The well density would depend on the nature of the coal, the sensitivity of the area to surface impacts, and the technology available. Each CBM well site will require a gravel pad containing one well within an enclosure, an enclosed generator to operate the pump or hydraulic system, a gas-separator and metering skid, and a storage tank for produced water surrounded by a spill containment dike. Depending on the projected size of the field, more than one pilot project could be necessary to adequately evaluate the prospect.

CBM wells are drilled in much the same way as conventional oil or gas wells. Three major concerns are addressed in the process of drilling a 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, during which 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 cemented in place, to provide structural integrity and to isolate the hole from surrounding water and other materials.

A typical CBM well begins with the drilling of a 14-inch hole to a depth of 60 to 80 feet. A 12-inch 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 groundwater and unconsolidated sediments of the surface from continually slumping into the hole.

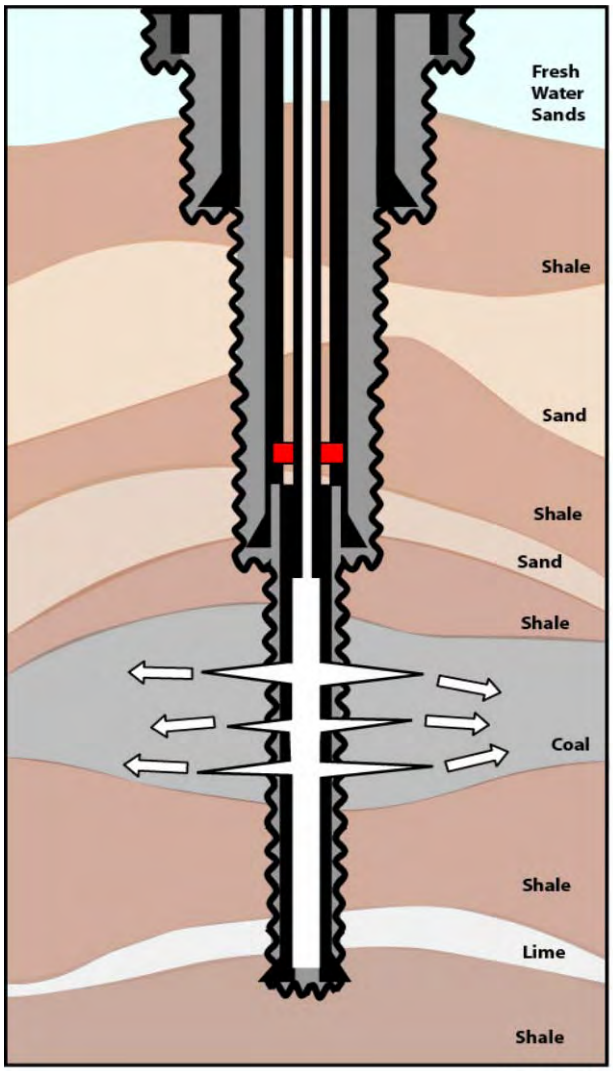
An 8-inch hole is then drilled to a depth of approximately 300 feet, normally 50 to 100 feet into bedrock. A 6-inch surface casing is then cemented in place from the top of the conductor pipe to the bottom of the hole. This provides a structural base for mounting a blowout preventer (BOP). The operator 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 a 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 normally are drilled in one or two additional stages of diameter and depth. Typically, a 5-inch hole is drilled to approximately 3,000 feet, and a 4-inch 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 eliminate the possibility of fluid migration between 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 pressure sufficient to separate the structure by causing linear cracks in the coal, 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. Figure D.1 shows a diagram of a typical CBM well.

Figure D.1. Cross section of a typical coalbed methane well.



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Appendix F: Sample Exploration License

Gas Only Exploration License
Form #DOG 2005-07

This is a draft document only.

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES

Holitna Basin Exploration License
ADL 390607

THIS GAS ONLY EXPLORATION LICENSE is issued by the State of Alaska, Department of Natural Resources ("the state" or "the department") to

HOLITNA ENERGY CO

("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 onlylLeases 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 an initial term of three (3) years from the effective date of the license. The license may be extended for up to seven (7) years beyond the initial term if the licensee: (1) has completed the work commitment state in Schedule 2 prior to termination of the initial term of the license; (2) requests the extension at least 90 days prior to termination of the initial term of the license; (3) commits to an additional work commitment under terms approved by the commissioner; and (4) has an acreage relinquishment plan approved by the commissioner. If this license is not extended it shall terminate automatically at the end of the initial term without further notice.

4. WORK COMMITMENT. This license is conditioned upon the performance of a work commitment, as required under AS 38.05.132, of $80,373.00. 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
HOLITNA ENERGY CO

(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

Mitigation Measures for Holitna Gas Only Exploration License

(Note: in the actual license, a copy of the mitigation measures will be inserted here.)

SCHEDULE 1

Legal Description
Holitna Gas Only Exploration License
ADL 390607

Legal Tract: 1

T. 16 N., R. 42 W., Seward Meridian, Alaska.

Section 5, Unsurveyed, All, 640.00 acres;
Section 6, Unsurveyed, All, 599.00 acres;
Section 8, Unsurveyed, All, 640.00 acres;

This Tract (1) contains 1,879.00 acres, more or less.

Legal Tract: 2

T. 16 N., R. 43 W., Seward Meridian, Alaska.

Section 1, Unsurveyed, All, including the bed of the Hoholitna River and excluding U.S. Survey 12384, 639.66 acres;

This Tract (2) contains 639.66 acres, more or less.

Legal Tract: 3

T. 17 N., R. 41 W., Seward Meridian, Alaska.

Section 6, Unsurveyed, All, 630.00 acres;
Section 7, Unsurveyed, All, 632.00 acres;

This Tract (3) contains 1,262.00 acres, more or less.

Legal Tract: 4

T. 17 N., R. 42 W., Seward Meridian, Alaska.

Section 1, Unsurveyed, All, including the bed of Big Lake, 640.00 acres;
Section 2, Unsurveyed, All, including the bed of Big Lake, 640.00 acres;
Section 3, Unsurveyed, All, 640.00 acres;
Section 10, Unsurveyed, All, 640.00 acres;
Section 11, Unsurveyed, All, 640.00 acres;
Section 12, Unsurveyed, All, 640.00 acres;
Section 13, Unsurveyed, All, 640.00 acres;
Section 14, Unsurveyed, All, 640.00 acres;
Section 15, Unsurveyed, All, 640.00 acres;

This Tract (4) contains 5,760.00 acres, more or less.

Legal Tract: 5

T. 17 N., R. 42 W., Seward Meridian, Alaska.

Section 4, Unsurveyed, All, 640.00 acres;
Section 5, Unsurveyed, All, 640.00 acres;
Section 7, Unsurveyed, All, 632.00 acres;
Section 8, Unsurveyed, All, 640.00 acres;
Section 9, Unsurveyed, All, 640.00 acres;
Section 16, Unsurveyed, All, 640.00 acres;
Section 17, Unsurveyed, All, 640.00 acres;
Section 18, Unsurveyed, All, 634.00 acres;

This Tract (5) contains 5,106.00 acres, more or less.

Legal **Tract: 6**

T. 17 N., R. 42 W., Seward Meridian, Alaska.

Section 19, Unsurveyed, All, 636.00 acres;
Section 20, Unsurveyed, All, 640.00 acres;
Section 21, Unsurveyed, All, 640.00 acres;
Section 28, Unsurveyed, All, 640.00 acres;
Section 29, Unsurveyed, All, 640.00 acres;
Section 32, Unsurveyed, All, including the bed of the Hoholitna River, 640.00 acres;
Section 33, Unsurveyed, All, 640.00 acres;

This Tract (6) contains 4,476.00 acres, more or less.

Legal **Tract: 7**

T. 17 N., R. 42 W., Seward Meridian, Alaska.

Section 22, Unsurveyed, All, 640.00 acres;
Section 23, Unsurveyed, All, 640.00 acres;
Section 24, Unsurveyed, All, 640.00 acres;
Section 25, Unsurveyed, All, 640.00 acres;
Section 26, Unsurveyed, All, 640.00 acres;
Section 27, Unsurveyed, All, 640.00 acres;
Section 34, Unsurveyed, All, 640.00 acres;
Section 35, Unsurveyed, All, 640.00 acres;

This Tract (7) contains 5,120.00 acres, more or less.

Legal **Tract: 8**

T. 18 N., R. 41 W., Seward Meridian, Alaska.

Section 31, Surveyed, by protraction, All, 628.39 acres;
Section 32, Surveyed, by protraction, All, 640.00 acres;

This Tract (8) contains 1,268.39 acres, more or less.

Legal **Tract: 9**

T. 18 N., R. 42 W., Seward Meridian, Alaska.

Section 33, Surveyed, by protraction, All, including the bed of the unnamed lake, 640.00 acres;
Section 36, Surveyed, by protraction, All, including the bed of Big Lake, 640.00 acres;

This Tract (9) contains 1,280.00 acres, more or less.

Aggregating 26,791.05 acres, more or less.

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	$ _____