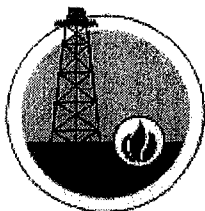
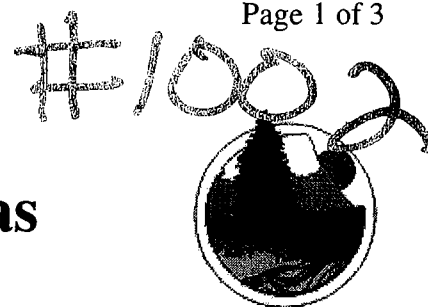


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State of Alaska
Division of Oil and Gas
 Department of Natural Resources



August 15, 2000

**Decision to Supplement North Slope Areawide Oil and Gas Lease Sale
 Best Interest Finding with Information on Polar Bears
 and Discussion of Comments Received**

Supplement to the Final Best Interest Finding

On March 17, 1998 the Alaska Department of Natural Resources (ADNR) Division of Oil and Gas (DO&G) issued a final best interest finding under AS 38.05.035 (e) and (g) regarding Oil and Gas Lease Sale 87, North Slope Areawide. On May 28, 1999, a Call for New Information was issued for North Slope Areawide 2000. Several comments were received in response to the call. However, before a decision could be issued regarding the sale, ADNR postponed the proposed sale pending the BP/ARCO merger. DO&G issued another call for new information because of the amount of time since the close of comments on North Slope 2000. This decision includes comments submitted in response to the May 28, 1999 and March 8, 2000 calls for new information. ADNR has also prepared a supplement to the cumulative effects section of the finding discussing new information on the effects of a major oil spill on polar bears.

In response to the May 28, 1999 call for comments, the Alaska Department of Fish and Game (ADF&G), U.S. Fish and Wildlife Service (USF&WS), and North Slope Borough (NSB) submitted comments. DO&G received comments from ADF&G, USFW&S, and the National Marine Fisheries Service (NMFS) in response to the March 8, 2000 call for new information.

In both comments, ADF&G stated that they had no new information. They also mentioned the performance of subsistence mitigation measures and recommendations of the NPR-A subsistence workshop in the 1998 Northstar EIS. Both of these subjects have been mentioned in prior comments and were taken into consideration by the department previously.

The North Slope Borough reiterated previous comments on the public process and the lack of a stakeholders process and public hearings in North Slope communities affected by the sale. These issues were addressed in Appendix A of Sale 87. They also mentioned Sale 87, the NPR-A Lease Sale, OCS Sale 170, the Badami, Tarn, Alpine, Northstar, Liberty and Fiord developments. However, they submitted no substantial new information.

In its comments submitted in response to the May 1999 call for new information, the USF&WS reiterated previous comments calling for the 1) deletion of concentrated calving areas used by caribou of the Central Arctic Herd; 2) the identification of key wetlands; 3) guidance on the design of cross-drainage structures; 4) aerial surveys of the proposed development area to determine the status of spectacled eiders; 5) the need for wildlife information to be updated; 6) the purpose of the creation of

ANWR and that leasing is not authorized on refuge lands; and 7) a request that the Service be notified with regard to potential conflicts over water withdrawals and water rights. None of these comments constitute substantial new information and they were addressed in Appendix A of Sales 86 and 87.

In response to the March 2000 call for new information, the USF&WS provided information on the recently published regulations pertaining to critical habitat designations for the threatened Steller's eider and spectacled eider. They also recently published regulations for the incidental take of polar bear and pacific walrus during oil and gas exploration activities on the North Slope. The regulations for the incidental take of polar bear and pacific walrus are an extension of existing regulations. This is not substantial new information.

ADNR has reviewed USF&WS proposals to name critical habitat under the Endangered Species Act for spectacled and Steller's eiders. These proposals, published in the Federal Register February 8, 2000 and March 13, 2000, were the result of a March 10, 1999 settlement of litigation. The lawsuit was originally filed in U.S. District Court against the Secretary of the Interior by several groups alleging failure to designate critical habitat for five listed species in California and two eider species in Alaska. In this settlement, the federal government agreed to reconsider its original finding of non-prudency regarding the designation of critical habitat for the seven listed species.

After discussion with ADF&G, it is ADNR's belief that no critical habitat for either spectacled or Steller's eiders exists on the North Slope and that there is no scientific information that demonstrates critical importance of the North Slope area for the recovery of either of these species. In addition, there is no evidence to date of a decline of these species in that area.¹ Based on the above discussion, I find the proposal to designate critical habitat is not new information that justifies a supplement to the finding.

NMFS called for a monitoring effort on living marine resources. They also may make recommendations to state agencies concerning essential fish habitat (EFH) for subsequent exploration or development activities. This, however, does not constitute substantial new information. If NMFS comes up with new information as a result of monitoring studies or makes EFH recommendations in the future, ADNR will consider them at that time.

ADNR has prepared a supplemental to the cumulative effects section of the finding discussing new information on the effects of a major oil spill on polar bears.

A person who is aggrieved by this decision may request the commissioner to reconsider the decision under AS 35.05.035(i) and (j). To be eligible an appellant must have meaningfully participated in the process by submitting written comments during the prescribed comment period. A request for reconsideration must be received by John T. Shively, Commissioner, Department of Natural Resources, 550 W 7th Ave, Suite 1400, Anchorage, Alaska 99501, or received by fax at 1-907-269-8918 by 5:00 p.m. (local time), September 5, 2000. If the commissioner fails to act on the request for reconsideration by September 14, 2000, the request is considered denied.

A denial of a request for reconsideration is the final administrative decision for purposes of appeal to Superior Court. A person may appeal to Superior Court only if the person was eligible to request, and did request, an administrative reconsideration of this decision by the commissioner. An appellant must initiate an appeal to the Superior Court within 30 days from the date of denial of that reconsideration or from the date of distribution of the denial decision, in accordance with the rules of court and to the extent permitted by applicable law.

John T. Shively

Commissioner

Appeal Code Number: OG81500.035

Footnote:

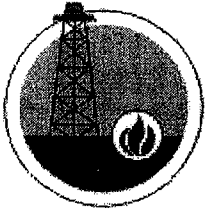
1. The decline in populations are in the Yukon-Kuskokwim Delta.

Maintained By: Jim Hansen



Last Revised August 15, 2000

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State of Alaska
Division of Oil and Gas
Department of Natural Resources



August 15, 2000

**Supplement to North Slope Areawide Oil and Gas Lease Sale
Best Interest Finding**

Decision to Supplement Best Interest Finding

Polar Bears

Oil Spills. Amstrup, (1999) conducted an overlay of polar bear densities and oil spill trajectories to estimate the number of polar bears that may be oiled by a hypothetical 3,600 bbl oil spill from the Northstar development project. Depending on wind conditions, the number of bears affected ranged from 0.4 to 78 during the open water period and from 0.1 to 108 during the broken ice period. The maximum number of bears potentially oiled was large, however oil-spill trajectories affected small numbers of bears far more often than they affected larger numbers of bears. In the open water period 50 percent of the trajectories affected 8 or fewer polar bears. The trend was similar during the broken ice period, although the median number of bears affected was 21 (Amstrup, 1999).

Spilled oil may concentrate in pools on the ice surface and accumulate in leads and openings until the dissipation of ice in the summer. This would increase the probability that polar bears and their principal food, ringed seals, will be directly oiled. Polar bears might then be subject to secondary exposure by consuming the oiled seals (Amstrup, 1999).

The study area was divided into grid cells and the entire cell was counted as oiled even if only a portion of it was touched by the spill. This exaggerated the potential effects on bears. Also, the study assumed that all bears exposed to oil were fatally affected. In real life this probably would not be the case (Amstrup, 1999). MMS estimates the loss of less than 50 polar bears out of a population of 1,300 to 2,500 would require 3 to 5 years to replace, assuming a growth rate of 2.4 percent (MMS, 1998:IV-G-17).

The study was particular to one development, Northstar, and the degree of impact depends on prevailing environmental conditions at the time. Ultimately, the calculation of risks to polar bears from an oil spill at Northstar or anywhere else must incorporate not only the risk once a spill occurs, but the probability of occurrence of a spill. Fortunately, there have been no marine oil spills in the Beaufort Sea in more than 25 years of exploration and development (Amstrup, 1999). There has never been an oil spill from a platform blowout in Alaska. The Northstar pipeline is designed to operate without leaking even if all the potential sources of failure, (ice gouging, strudel scour, settlement) occur at the same time and same location. This is an extraordinary conservative design basis. MMS evaluated the design of the Northstar project and concluded the risk of an oil spill (of 1,000 bbl or greater) was on the order of 1-2 percent. From all approaches reviewed, zero was the most likely number of spills ¹(MMS, 2000).

Technical design of pipelines and other facilities at the plan of operations phase reduce the chances of

oil spills. Measures included in this sale, in addition to normal oil spill prevention plan requirements (C-Plans), further avoid, reduce, or minimize oil spill risk to polar bears. Mitigation Measure 7 ensures that pipelines are designed to prevent accidental rupture or discharge from geophysical hazards, like ice scouring. This measure further reduces risk of an oil spill by prohibiting the transport of crude by tanker or any other means from offshore production sites once a subsea pipeline has been installed.

Mitigation Measures

The following are summaries of some applicable mitigation measures and lessee advisories. For the full text of mitigation measures and advisories, see the Sale Notice and Chapter Seven of the North Slope Areawide Final Finding.

* Pipelines must be designed and constructed to provide adequate protection from water currents, storm and ice scouring, and other geological hazards.

* Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, and cleanup of oil spills. Lining, diking and buffer zones are required to separate oil storage facilities from marine and freshwater supplies.

References

Amstrup, Steven C.

1999 Estimating Potential Effects of Hypothetical Oil Spills on Polar Bears

Anderson, Cheryl

2000 Personal communication from Cheryl Anderson, MMS, to Tom Bucceri, DO&G, regarding the most recent draft oil spill statistics, August.

MMS, (Minerals Management Service, U.S. Department of the Interior)

2000 Northstar Oil Spill Probability White Paper, June 12.

1998 Beaufort Sea Planning Area, Oil and Gas Lease Sale 170, Final EIS, February, MMS 98-0007.

Footnote:

1. Draft statistics for the entire U.S. OCS dated July 2000, show a spill rate of 1.33 per billion bbl transported for pipelines, 0.32 for platforms, 1.20 for tankers worldwide, and 0.98 for North Slope tankers. The spill rate for pipelines shows no significant change; tanker and platform spills are declining (Anderson, 2000).

Maintained By: Jim Hansen

CLOSE

Last Revised August 15, 2000

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Acknowledgments

The Alaska Department of Natural Resources acknowledges and expresses appreciation for the assistance of others outside the department in providing information that was vital to the examination of issues addressed in this finding. Those who provided assistance include:

- The Alaska Department of Community and Regional Affairs
- The Alaska Department of Environmental Conservation
- The Alaska Department of Fish and Game
- The Alaska Department of Labor
- The Alaska Department of Revenue
- The Alaska Oil and Gas Conservation Commission
- The Minerals Management Service
- The U.S. Fish and Wildlife Service
- The North Slope Borough
- The Public Participants

This publication was released by the Department of Natural Resources, Division of Oil and Gas. It was produced at a cost of \$9.50 per copy. The purpose of the publication is to meet the mandate of Alaska Statute 38.05.035(e). The publication was printed in Anchorage, Alaska.

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List of Abbreviations

AAC	Alaska Administrative Code	ACMP	Alaska Coastal Management Plan
ADCRA	Alaska Department of Community and Regional Affairs	ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game	ADNR	Alaska Department of Natural Resources
AEWC	Alaska Eskimo Whaling Commission	AMSA	Areas Meriting Special Attention
AOGCC	Alaska Oil and Gas Conservation Commission	AS	Alaska Statute
bbl	Barrel (42 gallons)	BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management	bpd	Barrels per day
DGC	Division of Governmental Coordination	DF	Division of Forestry
DL	Division of Land	DMWM	Division of Mining and Water Management
DO&G	Division of Oil and Gas	DPOR	Division of Parks and Outdoor Recreation
DW	Division of Water	EIS	Environmental Impact Statement
gal	Gallon(s)	m	Meter
MMS	Minerals Management Service	NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System	NSB	North Slope Borough
NSBMC	North Slope Borough Municipal Code	OCS	Outer Continental Shelf
RCRA	Resource Conservation and Recovery Act	SHPO	State Historic Preservation Officer
SPCC	Spill Prevention Control and Countermeasure	SWZ	Subsistence Whaling Zone
TLUI	Traditional Land Use Inventory	UIC	Underground Injection Control
USACE	U.S. Army Corps of Engineers	USC	United States Code
USDOJ	United States Department of the Interior	USF&WS	United States Fish and Wildlife Service

Metric and Standard Conversion Tables

To Metric		From Metric	
Feet	Meters	Meters	Feet
1	0.3	1	3.2
2	0.6	2	6.6
3	0.9	3	9.8
4	1.2	4	13.1
5	1.5	5	16.4
6	1.8	6	19.6
7	2.1	7	23
8	2.4	8	26.2
9	2.7	9	29.5
10	3	10	32.8
20	6	20	66
30	9	30	98
40	12	40	131
50	15	50	164
60	18	60	197
70	21	70	230
80	24	80	262
90	27	90	295
100	30	100	328
200	61	200	656
300	91	300	984
400	122	400	1312
500	152	500	1640
1000	305	1000	3281
1500	457	1500	4921

To Metric		From Metric	
Miles	Kilometers	Kilometers	Miles
1	1.6	1	0.6
2	3.2	2	1.2
3	4.8	3	1.9
4	6.4	4	2.5
5	8	5	3.1
6	9.7	6	3.7
7	11.3	7	4.3
8	12.9	8	5
9	14.5	9	5.6
10	16	10	6.2
20	32	20	12
30	48	30	19
40	64	40	25
50	80	50	31
60	97	60	37
70	113	70	43
80	129	80	50
90	145	90	56
100	161	100	62

Chapter One: Introduction

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Chapter One: Introduction

The state of Alaska is offering for lease lands on the North Slope in Oil and Gas Lease Sale 87, North Slope Areawide. This will be the state's first areawide oil and gas lease sale. The sale area consists of all unleased, state owned lands lying between the National Petroleum Reserve-Alaska (NPRA) on the west and the Arctic National Wildlife Refuge (ANWR) on the east, and from the Beaufort Sea in the north to the Umiat Meridian Baseline in the south. The sale area contains as much as 5,100,000 acres. This sale is scheduled for June 24, 1998.

Prior to holding a state oil and gas lease sale, the director, Division of Oil and Gas (DO&G), is required to determine whether the sale serves the best interests of the state. A best interest finding sets out the facts, statutes, regulations, and applicable policies upon which the determination is based. Two documents are issued by the DO&G; a Preliminary Best Interest Finding, and subsequently, a Final Best Interest Finding.

Alaska Statute 38.05.035 governs the disposal of state owned subsurface interests and includes public notice requirements referred to in this document (AS 38.05.035(e)(5) and AS 38.05.945). It also prescribes what, at minimum, must be in this final best interest finding document including a summary of comments on the proposed sale received by the division, which can be found in Appendix A. Chapters One through Nine represent the fulfillment of the statutory requirements contained in AS 38.05.035. A compilation of other laws and regulations applicable to oil and gas activities in Alaska can be found in Appendix B.

A. Areawide Sale Process

The purpose of areawide leasing is to provide an established time each year that the state will offer for lease all available acreage within three geographical regions: Cook Inlet, the North Slope, and the Beaufort sea. By conducting lease sales at a set time each year, the state will have a stable, predictable leasing program which will allow companies to plan and develop their exploration strategies and budgets years in advance. The result will be more efficient exploration and earlier development which will, in turn, benefit the state and its residents.

1. The Original Best Interest Finding

Prior to the 1996 legislative amendments, industry was asked to nominate areas to include in a lease sale, and the Department of Natural Resources (ADNR) sought public comment on the sale areas being proposed for addition to the program. Areawide leasing will include all available acreage within each geographic region, so there will no longer be the need for industry nominations. The process for collecting public comments and information for an original best interest finding will remain the same as it has been in the past (see description under section entitled "Public Participation" below). The statutory requirements for an original best interest finding have also remained unchanged. See description under "Statutory Background" below. The DO&G must still issue a preliminary best interest finding and allow the public at least 60 days to comment. Both the preliminary and final best interest findings must comply with AS 38.05.035(e) and (g). Previously, however, a best interest finding had a life of five years. As a result of amendments to AS 38.05.180 (d) and (w) by the legislature, once a finding has been written for an areawide sale, ADNR can then conduct a lease sale in that same area each year for up to ten years without having to repeat the entire finding process.

For each areawide sale, each geographic region has been divided into tracts that will remain fixed for future sales. The extent of the state's ownership interest in these lands will not be determined prior to the sale. Instead, following the sale ADNR will verify title only for acreage that is leased. Therefore, should a potential bidder require title or land status information for a particular tract prior to the sale, it will be the bidder's responsibility to obtain that information from ADNR's public records. It is possible that a tract included in the sale may contain land that the state cannot legally lease (existing lease, federal, Native or private land, etc.). Once title has been verified, the legal descriptions for each tract's leaseable acreage will be made available to the public for inspection prior to issuing the leases. Depending on the number of tracts leased and the complexity of the land holdings involved, it could be weeks to months following the sale before the leases are issued.

2. When an Original Best Interest Finding is not Required

During the 10 years following a best interest finding for a sale area, annual sales can be held without DO&G having to write a new finding (AS 38.05.035(e)(6)(F)). However, it may be necessary for DO&G to write a supplement to the finding prior to a lease sale. Approximately nine months before a sale, ADNR issues a call for comments requesting substantial new information that has become available since the most recent finding for that sale area was written. This request, sent to agencies and individuals on the division's mailing list, is also noticed in statewide and local newspapers with prominent display ads. Agencies and the public are given approximately two months in which to provide any new information. Based on information received, ADNR determines whether or not it is necessary to revise the finding. Either a supplement to the finding, or a decision of no new information is issued 90 days prior to the sale. Any person that has commented during the prescribed time, will have the reconsideration and appeal rights as described in AS 38.05.035.

Mitigation measures placed on earlier leases will be carried forward to all future sales unless, as a result of new information, ADNR deems it necessary to change some of the measures, or add additional ones. A new coastal management consistency review will be done whenever new information or conditions suggest the proposed lease sale may no longer be consistent with ACMP standards.

B. Oil and Gas Lease Sale 87

Publication of this final best interest finding follows professional and technical review of social, economic, environmental, geological, and geophysical information about the Sale 87 area, as well as comments received. This document describes the sale area and presents the department's review of the area's resources and history. It discusses the reasonably foreseeable effects that may occur as a result of oil and gas exploration, development, production, and transportation within the sale area. It also presents mitigation measures, including lessee advisories, to be imposed as plans of operation permit terms designed to reduce or eliminate any and all reasonably foreseeable adverse effects.

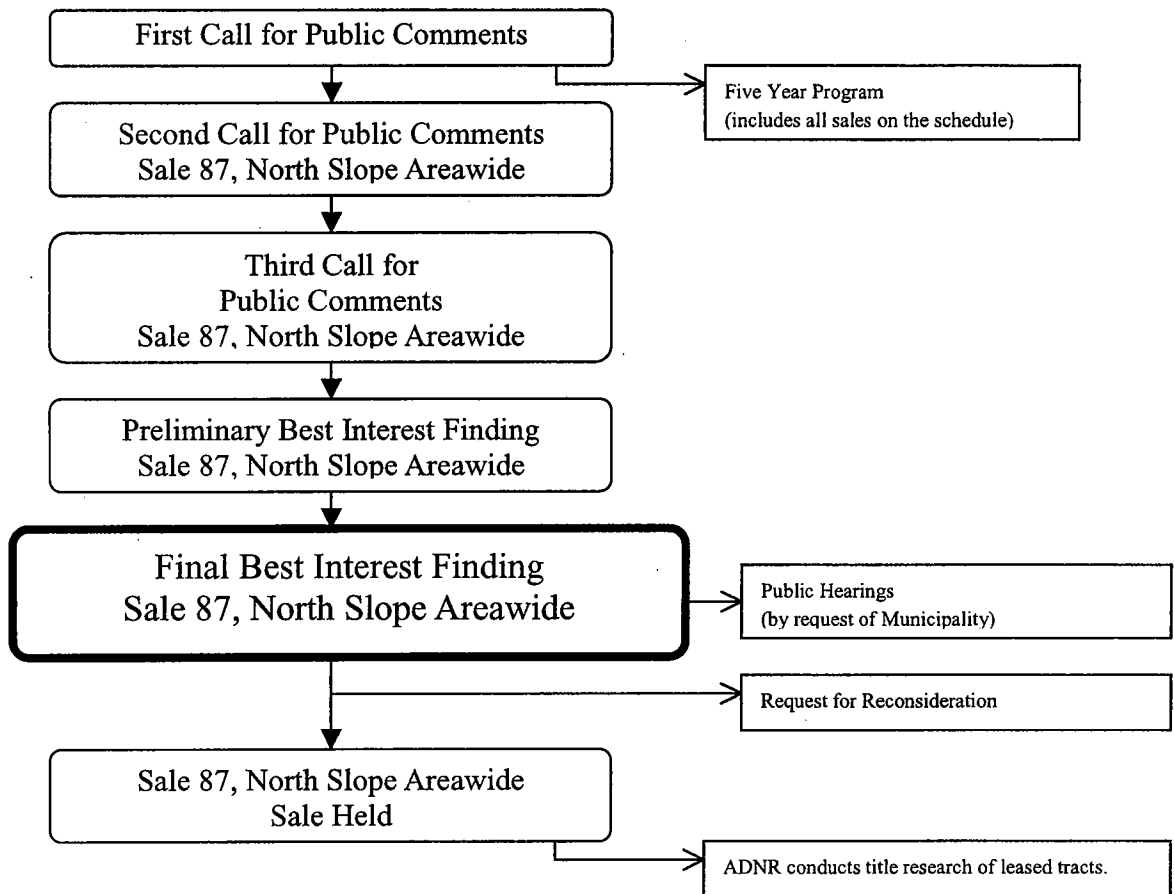
1. Sale 87 Scope and Status

The review of activities in the Sale 87 area is a multiphased development review. The director, in making this final finding, has limited the scope of the finding to the applicable statutes and regulations, facts, and issues that pertain solely to the lease sale phase of oil and gas activities, and the reasonably foreseeable significant effects of this sale. The three conditions under which phasing may occur, are met here. See AS 38.05.035(e)(1)(C).

Condition (a) is met because the only uses authorized by Sale 87 are part of the lease sale stage. The lease merely gives the lessee, subject to the provisions of the lease, the non-exclusive right to conduct geological and geophysical exploration for oil, gas, and associated substances within the leased area; and the exclusive right to drill for, extract, remove, clean, process, and dispose of any oil, gas, or associated substances that may underlie the lands described by the lease. While the lease gives the lessee the right to conduct these activities, the lease sale itself does not authorize any exploration or development activities by the lessee on leased tracts. Before any operation may be undertaken on the leased area, the lessee is required to comply with all applicable statutes and regulations, and secure approval of a plan of operations and all applicable permits.

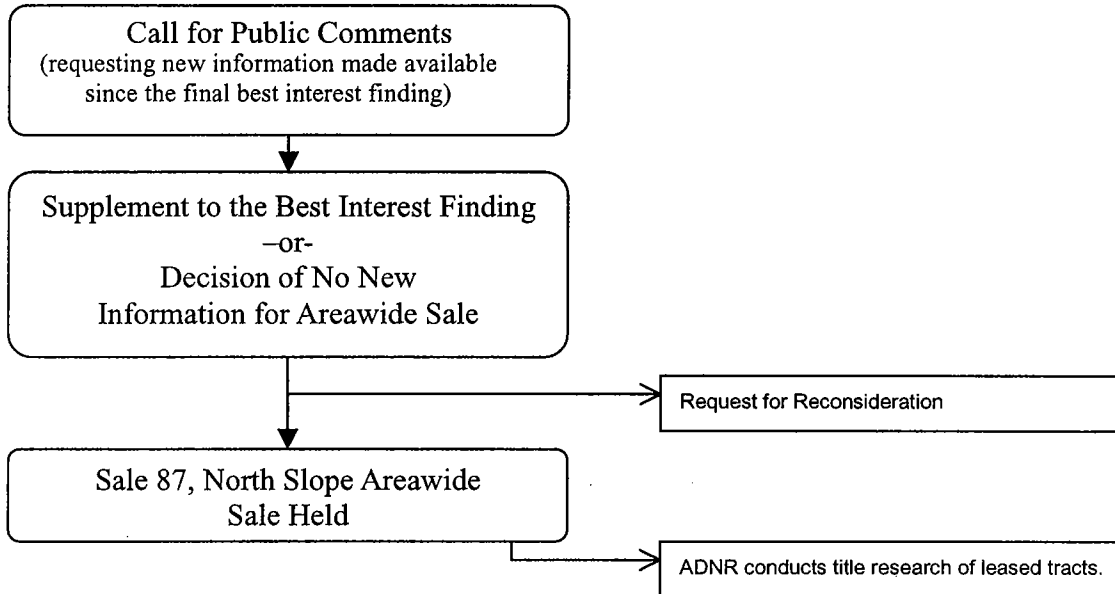
Condition (b) is met because state approval is required before the next phase (exploration) may proceed (see Chapter Five on the post-lease phases). Before exploration activities can occur on leased lands, the lessee must secure all applicable permits. Additional permits must also be prepared, and approved by the state, for any later development or production phase.

Lease Sale 87 Public Process



Lease Sale Public Process

(When an original finding is not required)



The plans of operation must identify the specific measures, design criteria, construction methods, and standards that will be employed to meet the provisions of the lease. Plans of operation are subject to extensive technical review by a number of local, state, and federal agencies. They are also subject to consistency with the Alaska Coastal Management Program (ACMP) standards, if the affected lands are within the coastal zone. The plans are available for public review upon submission to the state. Oil and gas exploration, development, or production-related activities will be permitted only if proposed future operations comply with all borough, state, and federal laws and the provisions of the lease.

Condition (c) is met because ADNDR is conditioning this best interest determination and any leases ultimately issued with a number of mitigation measures designed to ensure that any future activities in the exploration, and development and production phases will serve the best interests of the state. These mitigation measures have been developed by ADNDR through its review of the material facts and issues, including the reasonably foreseeable cumulative effects of oil and gas exploration, development, production, and transportation on the sale area.

Therefore, the scope of review in this finding is limited to the applicable statutes and regulations; the material facts and issues that are known to the director that pertain to the lease sale phase; and the reasonably foreseeable, significant effects of leasing. This includes all of the items referenced on the list in AS 38.05.035(g) and all material facts and issues raised by the public during the public comment period. These effects of specific future exploration, development and production will be considered at each phase, when permit applications for specific proposed activities at specific locations are reviewed by various government agencies and the public. This finding discusses the potential effects in general terms that may occur with oil and gas exploration, development, production, and transportation within the sale area, and the mitigation measures to be imposed as terms of the sale, as lease provisions, and as plans of operation permit terms to reduce or eliminate any possible adverse effects.

Figure 1.1 Map of the Sale Area

2. Public Process History

The state's oil and gas leasing process follows certain predictable steps and includes a specific timeline for reaching a decision on whether certain onshore and offshore areas should be leased for petroleum exploration and development.

Public Process History for Sale 87, North Slope Areawide		
Date	Action	Comments
7/21/92	5-Year Call for Comments	87 titled, Kuparuk Uplands and included lands from the Colville River to R15E U.M. and from the Beaufort Sea coast to T1S U.M.
7/7/94	5-Year Call for Comments	Sale area reconfigured to include lands between NPRA and R15E U.M. and from the Beaufort Sea to the Brooks Range
1/23/95	Call for Comments (6 mo.)	Request for general information. Display ads in newspapers. Comment period closed 6/30/95.
1/16/96	Amendment to Five-Year Oil and Gas Leasing Program	Sale reconfigured. Now includes lands between NPRA and ANWR, the Beaufort Sea and the Umiat base line.
5/23/96	Call for Comments (6 months)	Request for specific information.

The original Sale 87 area, as proposed in 1992, included onshore lands west of the Colville River to R. 15 E., U.M., and from the Beaufort Sea coast, south to R. 1S., U.M. Public comments were received pertaining to that sale configuration during the (7/21/92) comment period. In 1994, the entire sale area was reconfigured and the sale rescheduled. This new version of Sale 87 appeared in a call for comments on the Five-Year Oil and Gas Program dated July 7, 1994 and included the addition of about 1.25 million acres between NPRA and T.15 E., U.M., and from the Beaufort Sea to the Brooks Range. This comment period ended on September 7, 1994. A call for comments was issued on January 23, 1995, requesting general information. This comment period ended on June 30, 1995. On January 16, 1996 ADNR issued an announcement again reconfiguring the sale area. The new sale area consisted of lands bounded by NPRA on the west, ANWR on the east, the Beaufort Sea on the north and the Umiat Meridian base line on the south. This latest sale configuration consists of approximately 5,100,000 acres. A final call for comments was issued on May 23, 1996 and closed on November 23, 1996. This call requested specific socio-economic and environmental information. All written comments received by the division pertaining to any portion of the Sale 87 area from its earliest inception to the end of its final comment period are summarized and responded to in Appendix A.

All comments received are considered in the final determination whether Sale 87 is in the best interests of the state. DO&G has incorporated facts and issues into the corresponding discussion in this finding, however some issues raised by commentators may be addressed in the comments and responses section (Appendix A). Comments received contributed to the department's analysis of the sale's potential effects and selection of mitigation measures.¹

C. Statutory Background

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) and directed the ADNR to implement the statutes.

¹ The public comment period, in addition to helping tailor the scope of the finding, is important since under AS 38.05.035(i), a person is eligible to file a request for reconsideration and subsequently an administrative appeal with the superior court only if the person meaningfully participated in the process and is affected by the final written finding. A person meaningfully participates by submitting written comment during the period for receipt of public comment or by presenting oral testimony at a public hearing.

Under AS 38.05.035(e), an ADNR director 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. This written finding is known as a best interest finding and is a written analysis which describes for the public the facts and applicable law which are relevant to the disposal and gives a decision based on these factors. If the proposed activity occurs in a coastal area, AS 46.40 requires that the activity be consistent with the ACMP which includes approved local district coastal zone management plans.

AS 38.05.035(8) lists the topics that the DO&G must consider and discuss within the best interest finding analysis prior to determining whether an oil and gas lease sale is in the state's best interests:

- i. property descriptions and locations;
- ii. the petroleum potential of the proposed sale 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 sale area, including effects on subsistence uses, fish and wildlife habitat and populations and their uses, and historic and cultural resources;
- vii. lease stipulations and mitigation measures, including any measures to prevent and mitigate releases of oil and hazardous substances, to be included in the 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 lease sale area, and the advantages and disadvantages, and relative risks of each;
- ix. the reasonably foreseeable fiscal effects of the lease sale and the subsequent activity on the state and affected municipalities and communities, including the explicit and implicit subsidies associated with the lease sale, if any;
- x. the reasonably foreseeable effects of oil and gas exploration, development, production, and transportation on the municipalities and communities within or adjacent to the lease sale area; and
- xi. the bidding method or methods adopted by the commissioner under AS 38.05.180

The analysis must also discuss material issues that were raised during the period allowed for receipt of public comment.

1. Public Participation, Notices, and Hearings

The Alaska Constitution requires “prior public notice and other safeguards of the public interest as prescribed by law” prior to the leasing of state lands (Alaska Constitution, art. VIII, § 10).

Although not required by law, DO&G issues several requests or “calls” for public comment to assist the agency in gathering information to include in the best interest findings and focusing on issues of specific concern. These calls for comments are sent to local governing bodies, state and federal agencies, the oil industry, environmental organizations and members of the public who have requested to receive information on proposed lease sales. Gathering issues and information for a best interest finding for an oil and gas lease sale begins with the state’s proposed Five-Year Oil and Gas Leasing Program. Every other year, ADNR is required under AS 38.05.180(b) to prepare a five-year oil and gas leasing program which is made available to the legislature. Public involvement begins when the division requests public comment on a list of proposed sale areas for the Five-Year Program. Notification is given by public mailing and display ads in the newspapers (see Figure 1.2).

A second request for general information and identification of issues and concerns is mailed to the public and agencies approximately three years before the final best interest finding is issued. Mailing lists are maintained by DO&G and consist of the names and addresses of those members of the public who have requested to be on the mailing list for a particular area, as well as various state, federal, and local agencies. The public is given about five months to comment.

A third, and usually final, request for comments is mailed to the public and agencies about 18 months before the final best interest finding is issued. Again, a notice of this request for identification of issues and

information is mailed to individuals and groups. A display ad is also published in newspapers. The public is given approximately five months to comment. These requests for public comment occur prior to distribution of the preliminary finding, which is also subject to public review and comment.

Title 38 of the Alaska statutes requires DO&G to issue a preliminary best interest finding at least 180 days prior to an oil and gas lease sale. The division allows the public at least 60 days to review and comment on the preliminary best interest finding analysis under AS 38.05.035(e)(5)(A). Comments on the preliminary best interest finding are researched and considered by DO&G staff, and appropriate changes are made for the subsequent final finding. The division issues a final best interest finding at least 90 days prior to the sale. See AS 38.05.035(e)(5)(B).

The public notice statute, AS 38.05.945, includes specific provisions for best interest findings for oil and gas lease sales. These include:

- Publication of a legal notice in newspapers of statewide circulation and in newspapers of general circulation in the vicinity of the proposed action at least once a week for two consecutive weeks;
- Publication of a notice in display advertising form in the newspapers described above at least once a week for two consecutive weeks;
- Public service announcements on the electronic media serving the area to be affected by the proposed action; and
- One or more of the following: posting in a conspicuous location in the vicinity of the action; notification of parties known or likely to be affected by the action; or another method calculated to reach affected parties.

AS 38.05.946 provides that a municipality, an Alaska Native Claims Settlement Act (ANCSA) corporation, or nonprofit community organization entitled to receive a 30-day notice of issuance of either a preliminary or final best interest finding, may hold a hearing which the commissioner shall attend. The commissioner has the discretion to hold a public hearing also. Although not required by statute or regulation, ADNR may:

- (a) contact legislators serving areas affected by a lease sale and local governing bodies early in the lease sale process so that informational meetings with concerned citizens and organizations can be arranged; and
- (b) conduct its own public hearings in one or more communities affected by a proposed lease sale at least once during the 60-day public comment period immediately following the issuance of the preliminary best interest finding.

Additional meetings and hearings are intended to provide information to the public about a proposed lease sale in the area and to encourage public comment. All findings under AS 38.05.035(e) must include a summary of agency and public comments regarding the proposed disposal and ADNR's responses to those comments. For each fact or issue raised in the public comment period that is determined not material to the decision, the director must present an explanation in the best interest finding under AS 38.05.035(e)(2). This provides assurance that the issue or fact was indeed considered in making the best interest finding and provides an explanation to the commentor as to why the determination of non-materiality was made.

After a final best interest finding is issued, an individual or organization may request reconsideration at the agency level in accordance with AS 38.05.035(i). A request for reconsideration of a best interest finding must be filed with the commissioner of ADNR within 20 days after the issuance of the final best interest finding. In order to file a request for reconsideration, a person must have "meaningfully participated" in the administrative review process and must be affected² by the final decision. The term "meaningfully participated" means that the person (1) submitted written comment during a public comment period; or (2) presented oral testimony at a public hearing. An issue must be raised during comment period, but not necessarily by the individual, in order to be the basis for a request for reconsideration.

A person may appeal to the superior court only if the person requested reconsideration at the agency level and may appeal only those points the person raised in the request for reconsideration (AS 38.05.035(l)).

² Alaska case law defines "a person affected by a decision" as someone who has a personal stake in the results of the decision. *Sisters of Providence v. Dept. of Health & Social Services*, 648 P. 2d 970, 974 (Alaska 1982).

By requiring that a party exhaust the administrative review and reconsideration process before appealing to the superior court, the agency is given the fullest opportunity to review, analyze, and respond to the appealed concerns prior to litigation. For the purposes of review, the person appealing must state and prove the defect alleged to exist within the best interest finding.

2. Best Interest Finding Scope

The best interest finding scope is based on the facts and issues known or made known to the director and may address only reasonably foreseeable, significant effects of the lease sale (AS 38.05.035(e)(1)(A)). Legislative history indicates that for an effect to be "reasonably foreseeable": (1) there is some cause/result connection between the proposed disposal and the effect to be evaluated; (2) there is a reasonable probability that the effect will occur as a result of the disposal; and (3) the effect will occur within a predictable time after the disposal. These practical constraints eliminate speculation about potential but improbable future effects and focus the best interest finding on those effects which are most likely to occur, since it is impossible to predict whether, let alone when and where, development or production, and related facilities might occur.³ This concept is further clarified in AS 38.05.035(h) which states 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. Public input 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 assist the director in:

- reviewing all of the facts and issues;
- determining which are material to the decision of whether to lease the area in question;
- establishing the scope of the review for that decision by determining the reasonably foreseeable, significant effects of leasing that arise from those material facts and issues; and
- balancing those effects to determine under what conditions, if any, leasing the area will serve the best interests of the state.

3. Phased Review

Phased review recognizes that leasing of state land may result in future projects that cannot be predicted or planned with any certainty or specificity at the initial lease sale stage and that will require future detailed site-specific review prior to approval. In oil and gas leasing, it cannot be determined with any specificity or definition at the leasing stage if, when, where, how, or what kind of production might ultimately occur, as the result of leasing. Advances or the lack of advances in technology, along with market changes, while they cannot be predicted, may determine the answers to such questions. The lease sale phase only authorizes the transfer of mineral interests. At this phase there is no specific proposed development project and effects of the sale's subsequent activities are not predictable, with the exception of rental payments required annually by the state to keep the lease. Thus, the analysis in the best interest finding is limited to a non site-specific discussion of the known or reasonably foreseeable effects of oil and gas activities on human and natural resources.

For example, Chapter Six of this finding discusses likely methods of oil and gas transportation, like pipelines, in an Arctic environment, with attention to the known physical and biological characteristics of the

³ The probability that commercial production will ever occur on a tract offered in an oil and gas lease sale is very low. Statistics compiled by ADNR indicate that about half of the tracts (51.6 percent) offered in state oil and gas lease sales have been leased. Of these leased tracts, slightly more than 10 percent have actually been drilled on. About 5 percent of the tracts leased have been commercially developed for oil and gas production. This means that only a small percentage (approximately 3 percent) of state lands offered for lease have been commercially developed for oil and gas production (Kornbrath, 1995). It is important to note that the 3 percent production success to tracts offered ratio is a statewide average for sales held over a 33+ year time period. Considering changes in oil and gas recovery technology in recent decades, and that tracts continue to be offered and reoffered after they are relinquished, use of this average to estimate future effects of this sale, such as total surface impact, would be unreliable and misleading. For a discussion on surface impact as a result of oil and gas activities, see Chapter Five.

Sale 87 region. It does not and cannot discuss when, what kind, or where individual pipelines may be built. Such speculation concerning future development activities that will be subject to independent permitting requirements is not required by statute at the time a decision is made to lease.

Additional authorizations, such as plans of operation and permits, are required for exploration, development, and production phases. Phasing allows the analysis of proposed leasing to focus only on the issues pertaining to the lease sale stage and reasonably foreseeable significant effects of leasing and subsequent activities, such as exploration.

When a project is multiphased, review of issues which 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 and responsibilities at these later phases is in the section on "Governmental Powers" below.

ADNR is allowed to review projects as "multi-phased development," when three conditions are met (AS 38.05.035(e)(1)(C)).

- (a) the only uses to be authorized are part of the discrete phase being reviewed;
- (b) ADNR's approval is required before the next phase may proceed (i.e., a plan of operations or permit must be authorized before another phase or segment may begin); and
- (c) ADNR describes its reasons for allowing phased review and conditions the approval to ensure that any additional uses or activities proposed for that or any later phase will serve the best interests of the state.

Phased review is based in part on the fact that some multiphased projects are subject to continued review throughout the succeeding stages. Phased review is intended to allow for consideration of subsequent issues when sufficient data are available upon which to make reasonable decisions. Future phases cannot be reviewed with any accuracy when information regarding future activities is unknown, nonspecific, undefined, unavailable, or unreliable. As discussed above under Sale 87 Scope and Status," Lease Sale 87 meets each of the three conditions listed in AS 38.05.035(e)(1)(C).

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

All subsequent oil and gas activities, exploration, development, production, and transportation are subject to numerous federal, state, and local laws, regulations, policies, and ordinances. Each successful bidder awarded a lease in a state oil and gas lease sale is obligated to comply with all federal, state, and local laws. A sample lease contract is contained in Appendix E. This section does not provide an exhaustive description of all federal, state, and local laws and regulations that may be applicable to such activities. However, it does provide a sufficient illustration of the broad powers of various government agencies to prohibit, regulate, and condition any activities related to oil and gas which may ultimately occur on Sale 87 leases. A list of important laws and regulations applicable to oil and gas activities is included in Appendix B. Each of the regulatory agencies, (state, federal, and local) has a different role in the oversight and regulation of post-lease sale activities.

Each lease issued as a result of Sale 87 will grant the lessee exclusive rights to subsurface mineral interests. However, as discussed in the previous section, a lease does not authorize subsequent exploration or development. The lessee's rights are subject to the terms of the sale and the provisions of the lease (including the mitigation measures contained in Chapter Seven), all applicable state and federal laws and regulations, and may allow the lease holder to drill for, extract, remove, clean, process, and dispose of any oil, gas, or associated substances that may underlie the lands described by the lease.

Major permits and approvals that each agency requires are presented below, with additional information on the review process (see Table 1A and 1B). There is, however, no "typical" project. Actual processes, terms and conditions will vary with time-certain, site-specific operations. 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 as agency procedure will change from time to time.

1. Alaska Coastal Management Plan Review

Permit applications for post-lease sale activities must be as detailed as necessary for a comprehensive agency review. If a project affects or occurs within a coastal area, an ACMP review of the permit application will be conducted to determine whether the proposed activity is consistent with the standards of the ACMP. Following the review, each agency will approve or disapprove the permit and determine whether any additional protective stipulations or permit terms are required prior to approval.

The public is provided the opportunity to participate in ACMP reviews. For example, most permits needed for exploration well drilling require public notice. The ACMP permitting process goes through a 50-day agency review, and if approvals are needed by many agencies, the review may be coordinated by DGC. This process provides for coordinated agency reviews, public input, and insures consistency with the ACMP and local coastal district plans. The coastal district plan applicable to Sale 87 is the NSBCMP.

Application packages are distributed to affected coastal resource districts and permitting agencies by the lessee or designated operator, and DGC. Consistency review is initiated, and requests for additional information must be requested within 25 days. Public and agency review of comments are due on or before day 34, and a proposed consistency finding is issued on or before day 44. Requests for additional review must be received on or before day 49, and the Final Consistency Determination is issued (unless elevated) on day 50. If the determination is elevated, a director's determination is issued by day 65. A citizen can petition for Coastal Policy Council review of the proposed consistency determination after the elevation of issues.

ACMP reviews are not required for all operations. Some activities can be authorized without an ACMP review, under a general concurrence from either the "A" or "B" lists.

"A" List activities are activities which do not result in significant impacts to coastal resources and they do not require a consistency determination review. Cleanup activities of an existing pad are an example of an A list activity.

"B" List General Concurrence activities are considered routine activities, that with standard conditions, are consistent with the ACMP. Individual ACMP consistency reviews are not necessary for activities that only require permits on the B List. However, a Coastal Project Questionnaire (CPQ) application is required for all projects on the B List.

The coordinating agency(s) will check the CPQ to ensure that the project meets the requirements of the B List General Concurrence. The coordinating agency will also go over the standard stipulations and any applicable procedures with the applicant to ensure that they will be met. Activities not on the A or B lists constitute the C list and are subject to the review process described at the beginning of this section.

TABLES 1A and 1B Permit Process

2. Alaska Department of Natural Resources (ADNR)

The Department of Natural Resources (ADNR), through the Divisions of Oil & Gas, Mining and Water Management, and Land, reviews, coordinates, conditions, and approves plans of operations or development and other permits as required before on-site activities take place. The department also monitors activities through field inspection once they have begun. Each plan of operations is site-specific and must be tailored to the activity requiring the permit. A plan of operations must identify the specific measures, design criteria, and construction methods and standards to be employed to comply with the terms of the lease. It must also comply with coastal zone consistency review standards and procedures established under 6 AAC 50 and 80. Applications for other state or federal agency authorizations or permits must be submitted with the plan of operations.

Lease Operations Plan of Approval: Land use activities on state oil and gas leases are regulated by 11 AAC 83.158 and paragraphs 9 and 10 of the lease contract. These require the lessee to prepare a plan of operations that must be approved by ADNR through DO&G and by any other interest holder, if ownership is shared, before the lessee may commence any activities on the lease. Except for equipment uses exempted under 11 AAC 96.020, the lessee must prepare a plan of operations and obtain all required approvals and permits for each phase of exploration, development, or production prior to implementation of that activity. All permit applications and plans are available for public review.

An application for approval of a plan of operations must contain sufficient information, based on data reasonably available at the time the plan is submitted in order 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 the leased area, including the date operations are proposed to begin and their proposed duration;
- (2) projected use requirements directly associated with the proposed operations, including but not limited to 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 lease 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 leased area and adjacent areas, including fish and wildlife habitats, historic and archeological sites, and public use areas.

Other stipulations, in addition to the mitigation measures already developed at the lease sale stage, may be required at the plan of operations approval stage. These will address site-specific concerns directly associated with the proposed project. The lease stipulations and the terms and conditions of the lease are attached to the plan of operations approval and are binding on the lessee. Lease activities are field monitored by ADNR, ADEC, ADF&G, and AOGCC to ensure compliance with each agency's respective permit terms. Paragraph 16 of the lease contract requires that the lessee keep the lease area open for inspection by authorized state officials. The lessee must post a \$500,000 statewide bond to cover a drill site. Lease operations approvals are generally granted for three years.

Geophysical Exploration Permit: The geophysical exploration permit is a specific type of land use permit issued by the Division of Oil and Gas (11 AAC 96.010(a)(1)(E)). Seismic surveys are the most common activity authorized by this permit. The purpose of the permit is to minimize adverse effects on lands and resources while making important geological information available to the state. Under AS 38.05.035(a)(9)(c) the geological and geophysical data are held confidential at the request of the permittee.

Seismic surveys using vibroseis vehicles on the North Slope during winter have been found to be consistent with the ACMP provided certain conditions are adhered to. Seismic surveys in any other area of the state are subject to individual 30-day ACMP reviews. If the survey is part of an exploration program, the permit will be reviewed as part of the exploration well permit package.

The application must contain sufficient detail to allow evaluation of the activities' effects on the lands and resources. A map showing the general location and routes of travel, and a description of the activity and equipment that will be used must be included. 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 usually required.

The permit will contain measures to protect the land and resources of the area. The permit is usually issued for one year or less, but may be extended. If the permit is extended the director may modify existing terms or add new ones. The permit is revocable.

Pipeline Right-of-Way: Most transportation facilities within the lease area or beyond the boundaries of the lease 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, which are in whole or in part located on state land, to ensure that the state's interests are protected. The Right-of-Way Leasing Act permits are administered by the Joint Pipeline Office.

Temporary Water Use Permit: Under 11 AAC 93.210-220, Temporary Water Use permits are issued by the Division of Mining and Water Management and may be required for exploration activities. An application for a temporary water use permit must be made if the amount of water to be used is a significant amount as defined by 11 AAC 93.970(14), the use continues for less than five consecutive years, and the water applied for is not otherwise appropriated. The permit may be extended one time for good cause for a period of time not exceeding five years. The application must include: (1) the application fee; (2) a map indicating the location of the property, take point, and 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 to be used to withdraw the water. At the discretion of the commissioner, a temporary water use permit will be subject to conditions, including suspension and termination in order to protect the water rights of other persons or the public interest.

Permit and Certificate to Appropriate Water: Industrial or commercial use of water requires a Permit to Appropriate Water (11 AAC 93.120). The permit is issued for a period of time (not to exceed five years for industrial or commercial uses) consistent with the public interest and adequate to finish construction and establish full use of water. The commissioner will, in his discretion, issue a permit subject to conditions he considers necessary to protect the public interest. The conditions include, but are not limited to, conditions that reserve a sufficient quantity of water to achieve any of the following purposes: protection of fish and wildlife habitat, recreation, navigation, sanitation and water quality, protection of prior appropriations and for any other substantial public purpose.

A Certificate of Appropriation (11 AAC 93.130) will be issued if (1) the permit holder has shown that the means necessary for the taking of water have been developed; (2) the permit holder is beneficially using the amount of water to be certified; and (3) the permit holder 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, the applicant may be required to maintain a specific quantity of water at a given point on a stream or waterbody, or in a specified stretch of stream, throughout the year or for specified times of the year in order to protect fish and wildlife habitat, recreation, navigation or prior appropriations (11 AAC 93.130(c)(1)).

Land Use Permits: 11 AAC 96.010-140. Land Use Permits are issued by the Division of Land and may be required for exploration, development and production activities. Permits have a term of one year. All land use activities are subject to the following provisions:

- (1) Activities employing wheeled or tracked vehicles shall be conducted in such a manner as to minimize surface damage;
- (2) Existing roads and trails shall be used whenever possible. Trail widths shall be kept to the minimum necessary. Trail surface may be cleared of timber, stumps, and snags. Due care shall be used to avoid excessive scarring or removal of ground vegetative cover;
- (3) All activities shall be conducted in a manner that will minimize disturbance of drainage systems, changing the character, polluting, or silting of streams, lakes, ponds, waterholes, seeps, and marshes, or disturbance of fish and wildlife resources. Cuts, fills, and other activities causing any of the above disturbances, if not repaired immediately, are subject to such corrective action as may be required by the director;

- (4) The director may prohibit the disturbance of vegetation within 300 feet of any waters located in specially designated areas as prescribed in 11 AAC 96.010(2) except at designated stream crossings;
- (5) The director may prohibit the use of explosives within one-fourth mile of designated fishery waters as prescribed in 11 AAC 96.010(2);
- (6) Trails and campsites shall be kept clean. All garbage and foreign debris shall be eliminated by removal, burning, or burial, unless otherwise authorized;
- (7) All survey monuments, witness corners, reference monuments, mining claim posts, and bearing trees shall be protected against destruction, obliteration, or damage. Any damaged or obliterated markers shall be reestablished in accordance with accepted survey practice of the division;
- (8) Every reasonable effort shall be made to prevent, control, or suppress any fire in the operating area. Uncontrolled fires shall be immediately reported;
- (9) Holes, pits, and excavations shall be filled, plugged, or repaired to the satisfaction of the director. Holes, pits, and excavations necessary to verify discovery on prospecting sites, mining claims, and mining leasehold locations may be left open but shall be maintained as required by the director;
- (10) No person may engage in mineral exploratory activity on land, the surface of which has been granted or leased by the state of Alaska, or on land for which the state has received the reserved interest of the United States until good faith attempts have been made to agree with the surface owner or lessee on settlement for damages which may be caused by such activity. If agreement cannot be reached, or lease or surface owner cannot be found within a reasonable time, operations may be commenced on the land only with specific approval of the director, and after making adequate provision for full payment of any damages which the owner may suffer;
- (11) Entry on all lands under mineral permit, lease, or claim, by other than the holder of the permit, lease, or claim or his authorized representative, shall be made in a manner which will prevent unnecessary or unreasonable interference with the rights of the permittee, lessee, or claimant. Additional stipulations may be imposed.

Material Sale Contract: A material sale contract must include, if applicable, but is not limited to (1) a description of the sale area, (2) the volume of material to be removed, (3) the method of payment, (4) the method of removal of the material, (5) the bonds and deposits required of the purchaser, (6) the purchaser's liability under the contract, (7) the improvements to and occupancy of the sale area required of the purchaser, (8) and the reservation of material within the sale area to the division, (9) the purchaser's site-specific operation requirements including, but not limited to, 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 is to be completed. The director at his discretion may grant an extension not to exceed one year. When determined by the director that a delay in completing the contract is due to causes beyond the purchaser's control, the contract will be extended for a time period equal to the delay.

The director, in his discretion, will require a purchaser to provide a performance bond 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.

3. Alaska Department of Environmental Conservation (ADEC)

The Department of Environmental Conservation (ADEC) has statutory responsibility for preventing air, land, and water pollution. Oil and gas activities, such as the disposal of drilling mud and cuttings, the flaring of hydrocarbon gases, and the discharge of wastewater, are regulated by this agency as well as the Oil and Gas Conservation Commission if the activity involves a class II injection well. Several separate written permits are required before activity can begin. Before a solid waste disposal, wastewater or air quality permit is issued, two public notices and an opportunity for public comment (and a public hearing, if requested) are required.

Oil Discharge Prevention and Contingency Plan: Lessees 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 and 18 AAC 75.445). Details on the contents of the plan are in Chapter Six.

Prior to receiving a permit to drill, the lessee must demonstrate in the plan of operations the ability to promptly detect, contain, and cleanup any lease-related hydrocarbon spill before the spill impacts fish and wildlife populations or their habitats. This includes the capability to drill a relief well in the event of a loss of well control. ADEC has authority under AS 46.04 over both onshore and offshore activities 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 prior to 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.

Wastewater Disposal: Domestic greywater must be disposed of properly at the surface and a Wastewater Disposal Permit is required (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.

Annular Injection: If fluid is to be injected into a well annulus, a permit is required. ADEC considers the volume, depth and other physical and chemical characteristics of the formation designated to receive the waste. Injection 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.

Solid Waste Disposal Permit: Recent industry practice has been to utilize methods other than surface reserve pits for disposal of drilling muds, such as injection wells, where possible. In addition, the majority of muds utilized today are water-based. When a well is drilled, muds and cuttings are initially either temporarily stored on a gravel pad or collected in a reserve pit pending final disposal via injection. Drilling muds and cuttings discharged into a reserve pit require pre-approval and a written permit. The permit addresses design, operation and closure concerns to assure that unacceptable environmental effects are avoided.

Solid waste storage, treatment, transportation and disposal are regulated under 18 AAC 60. For all solid waste disposal facilities, 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 assure 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 ACMP and Alaska Historic Preservation Act (18 AAC 60.215). 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 a 1/2-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 (MSWL). MSWL's 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 is not an inactive reserve pit (18 AAC 60.990(81)). An inactive reserve pit is a drilling waste disposal area, containment structure, or group of containment structures where drilling waste has been disposed of which the owner or operator does not plan to continue disposing of drilling waste (18 AAC 60.990(61)). 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 and signed and sealed by a registered engineer (18 AAC 60.430(c)(5)).

Today, North Slope drilling fluids are disposed of by reinjection deep into the ground. In the past, muds and cuttings were disposed of using surface disposal methods (reserve pits). Reserve pits must still be constructed for every well. Before a well may be permitted under 20 AAC 25.005, a proper and appropriate reserve pit 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 ground water 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. Typical dimensions may be 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 reestablished. Surface impoundment's 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 classified as "hazardous" undergo a more rigorous and thorough permitting and review process by both ADEC (18 AAC 62 and 63) and EPA.

Air Quality Control Permit to Operate: The federal Prevention of Significant Deterioration (PSD) program, which is administered by ADEC, establishes threshold amounts for the release of byproducts into the atmosphere. Oil and gas exploration and production operations with emissions below predetermined threshold amounts must still comply with state regulations designed to control emissions at these lower levels (18 AAC 50). Activities which exceed pre-determined PSD threshold amounts are subject to a more rigorous application and review process. Such activities include the operation of turbines and gas flares.

For oil and gas activities, these requirements translate into the requirement for a permit to flare gas during well testing (a safety measure) or when operating smoke-generating equipment such as diesel-powered generators. Permit conditions will induce additional scrutiny if a black smoke incident exceeds 20 percent opacity for more than 3 minutes in any 1-hour period.

The burning of produced fluids is prohibited unless failures or seasonal constraints preclude storage in tanks, backhauling or reinjection. If liquids are to be incinerated, they must be burned in smokeless flares. The open burning of produced liquids is prohibited except under emergency conditions.

Gas produced as a by-product of oil production is usually reinjected into the producing formation to maintain pressure which supports further production. Flaring is not an approved method of disposal, however, as a safety measure and backup for standard gas handling systems production facilities, which separate gas from oil, are capable of flaring large volumes of gas. Flaring occurs when the oil and gas separation process is interrupted, or when an unplanned event requires an immediate release from pressure increases. Pilot flares are an operational necessity; they are subject to permit requirements as well.

401 Certification: Under 18 AAC 15.120 a person who conducts an operation which results in the disposal of wastewater into the water of the state need not apply for a permit from ADEC if the disposal is permitted under an NPDES permit. When an NPDES permit is issued under Section 401 (33 U.S.C. § 1341) of the Clean Water Act, ADEC does not require a separate permit, but participates by certifying that the discharge meets state and federal water quality standards.

When an application is made, a duplicate must be filed with the department and public notice of the certification application is published jointly by EPA and ADEC (18 AAC 15.140 and 40 C.F.R. § 125.32). As a result, the state and federal reviews run concurrently. Public comment is sought and a hearing can be requested.

Following an EPA determination, but within 30-days, the department must provide the applicant, EPA, and all persons who submitted timely comments with a copy of the certification. The decision may impose stipulations and conditions (such as monitoring and/or mixing zone requirements), and any person disagreeing with the decision may request an adjudicatory hearing (18 AAC 15.200-920). Once activity begins, both EPA and the department have the responsibility to monitor the project for compliance with the terms of the permit.

The Corps of Engineers 404 permit program (see Corps of Engineers) also requires certification under section 401 of the Clean Water Act and it is processed in a similar manner. The ADEC certification is termed a Certificate of Reasonable Assurance.

Review Process: Following receipt of an application for a permit to dispose of solid waste disposal, wastewater, or air quality permit, ADEC must publish two consecutive notices in a newspaper of general circulation in the area affected by the proposed operation as well as through other appropriate media.

Comments must be submitted in writing within 30-days after the second publication and a public hearing may be requested. A hearing will be scheduled if good cause exists. Notice of a public hearing is handled in a manner similar to that of the initial application. Permits issued by the department may be subject to review for consistency with the Alaska Coastal Zone Management Program.

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

4. Alaska Department of Fish and Game (ADF&G)

The Alaska Department of Fish and Game analyzes the effect of any activity on fish and wildlife, the users of those resources, and the protection of habitat. ADF&G requires permits for any activity in state game refuges, sanctuaries, critical habitat areas, and streams that contain anadromous fish, as well as other areas the agency believes might be threatened by development. Management plans control activities within many legislatively designated areas. By statute these areas are jointly managed with the Department of Natural Resources. Permits are conditioned to mitigate impacts. For example, timing restrictions are used to limit the impact on transitory wildlife. Public notice of ADF&G permit actions is not required.

Fish Habitat Permit: Title 16 gives ADF&G permitting authority over activities affecting anadromous fish streams that could block fish passage. A fish habitat permit must be obtained from ADF&G prior to using, diverting, obstructing, polluting, or changing the natural flow or bed of anadromous streams (AS 16.05.870). If the proposed activity obstructs fish passage, a fishway and device for the safe passage of downstream migrants may be required under AS 16.05.840.

Additionally under the ACMP, wetlands and tidelands must be managed to assure adequate water flow, avoid adverse effects on natural drainage patterns, and the destruction of important habitat (6 AAC 80.130(c)(3)). Rivers, streams, and lakes must be managed to protect natural vegetation, water quality, important fish or wildlife habitat, and natural water flow (6 AAC 80.130(c)(7)). To further protect fish and wildlife habitat, 6 AAC 80.070(b)(3) requires that facilities be consolidated, to the extent feasible and prudent.

Disposal of Wastes: AOGCC must also review and approve proposals for the underground disposal of water and oil field waste (20 AAC 25.252). Before receiving an approval, an operator must demonstrate to the commission that the movement of fluids into freshwater sources will not occur. Disposal must be into a well with equipment designed to assure a controlled release. A plat is required showing the location of other wells within a quarter-mile that penetrate the same disposal zone, and surface owners (located within one quarter-mile) must be provided with a copy of the application.

Included with a description of the fluid to be injected (with its composition, source, daily amount and disposal pressures), the application must contain the name, description, depth, thickness, lithologic description and geological data of the disposal formation and adjacent confining zones. There must be evidence presented that the disposal well will not initiate or propagate fractures through the confining zones that would allow fluids to migrate: a laboratory analysis is required. Under certain circumstances, however, a fresh water aquifer exemption may be granted (20 AAC 25.440).

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

Review Process: Actions by the commission that have statewide application (such as adopting regulations) are conducted in accordance with the Administrative Procedures Act. Major actions, resulting 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 mailing list is maintained for the purpose of sending notices, orders or publications to those who request them. There are different lists for different purposes.

6. U.S. Environmental Protection Agency (EPA)

NPDES Permit: The federal Clean Water Act requires a National Pollution Discharge Elimination System Permit (NPDES) to release pollutants into the waters and wetlands of Alaska. The permitting system is designed to ensure that discharges do not violate state and federal water quality standards by identifying control technologies, setting effluent limitations, and gathering information through reporting and inspection.

Typically, approved discharges are covered by a general permit developed through a public review process after the specific location of a proposed discharge has been identified by the EPA in an Authorization to Discharge. When a general permit for a specific geographical area does not exist, proposed discharges are subject to an individual approval process and NPDES permit.

When issued, a NPDES permit covers the discharge of drilling muds, cuttings and wash water, as well as 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, waterflooding discharges, produced waters, well treatment fluids and produced solids.

Review Process: Discharges needing authorization before a general permit is issued require individual permits (40 C.F.R. § 122). Once EPA receives an application for a proposed discharge, a draft permit and fact sheet is prepared to address the proposal. Public notice solicits comments and provides notification of state certification under section 401 of the Clean Water Act. It also initiates a review for consistency with the ACMP.

There is a minimum period of 30-days for public comment and all comments received must be in writing. Public hearings, if scheduled in the original notice, will be canceled if there is no interest in holding them; however, anyone can request a hearing.

If issued, an individual permit will not take effect for 30-days, during which time an aggrieved party who earlier submitted written comments may request an evidentiary hearing. EPA will respond by issuing a finding identifying the qualifying issues to be decided before an adjudicatory law judge. For general permits, notice must be published in the Federal Register and issuance may be challenged for 120-days (40 C.F.R. § 124).

A permit will not be issued unless ADEC certifies that the discharge will comply with the applicable provisions of the Clean Water Act. The certification process is addressed in an agreement between EPA and ADEC. In addition, the proposed activity must be consistent with the requirements of the Alaska Coastal Management Plan.

Persons wishing to comment on a state consistency determination or 401 certification must submit written comments within the 30-day comment period.

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

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

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

SPCC Plans: 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 in accordance with 40 C.F.R. 112. Drilling rigs are included in this facility definition. The purpose of the SPCC plan is to prevent discharges of oil into navigable waters of the U.S. and the adjoining shorelines. The plan must address three areas:

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

The SPCC plan is facility-specific and is part of the required documentation that must be present at the facility. The owner or operator must have the plan certified by a registered engineer but does not submit it to EPA for approval prior to the beginning of operations. The plan must be available for inspection at the facility. 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 SPCC plan to the EPA and the ADEC for review. The SPCC plan differs from the facility response plans (FRP) required by OPA 90 in that the SPCC plan focuses on prevention and the FRP focuses on response.

7. U.S. Army Corps of Engineers

The Department of the Army regulatory program is administered by the U.S. Army Corps of Engineers (Corps). The program is authorized by section 10 of the Rivers and Harbors Act of 1899, section 404 of the Clean Water Act, and section 103 of the Marine Protection, Research and Sanctuaries Act. The permit program authorizes activities in, on, or affecting, navigable waters as well as the discharge of dredge or fill into waters of the United States.

For purposes of administration, waters of the United States includes wetlands. The most common oil and gas activity requiring a Corps permit is the discharge or placement of fill, generally gravel or ice, on “wetlands.”

The Environmental Protection Agency and the Corps jointly administer the 404 program. The Corps performs the day-to-day permitting and enforcement functions (including individual permit decisions) and jurisdictional determinations, while EPA develops and interprets environmental criteria to be used in the evaluation of permit applications. The 404(b)(1) guidelines are EPA regulations; as a result, they can (and have) exercise veto authority over permit decisions made by the Corps.

Section 10 of Rivers and Harbors Act of 1899 (33 U.S.C. § 403): If work is anticipated to be performed on or in (or affect) navigable waters, a permit from the Corps is required. A section 10 permit addresses activities that could obstruct navigation. Oil and gas activities requiring this type of permit would be exploration drilling from a backup drill rig, installation of a production platform, or construction of a causeway. The process and concerns are similar to those required for section 404 approval and, at times, both may be required.

Individual Permits, General Permits and Letters of Permission: Some oil and gas activities undergo individual project reviews. Under this process, projects are evaluated on a case-by-case basis and a public interest determination (33 C.F.R. § 320) is conducted. The Corps issues general permits that carry a standard set of stipulations that cover frequent, repetitive and similar activities when, individually and cumulatively, there will be a minimal environmental effect. A general permit describes the activity covered and includes appropriate proposed stipulations and mitigation measures. This type of permit generally has a geographical limitation. There are 36 nationwide general permits while the Alaska District has 21.

Letters of Permission (LOP): LOPs are a type of permit that, once approved for issuance after a public review process, undergo individual, but abbreviated reviews. These activities are routine and have been determined to have no significant environmental effect. In Alaska, LOPs are used only for activities that might have an affect on navigable waters under section 10.

Review Process: Upon receipt of an application, the Corps solicits comments from the public, federal, state and local agencies as well as other interested parties. They seek comments to assess the impact of the proposed activity on aquatic resources, endangered species, historic properties, water quality, environmental effects and other public interest factors. Most public comment periods last 30-days and a public hearing can be requested.

The U.S. Fish and Wildlife Service, National Marine Fisheries Service and the Alaska Department of Fish and Game submit comments to the Corps in accordance with the Fish and Wildlife Coordination Act. Their comments address compliance with section 404(b)(1) of the Clean Water Act as well as the measures they consider necessary for the protection of wildlife resources. Endangered species that frequent the area are identified and the effect the proposed activity might have on them or their habitat is considered (Endangered Species Act 1973, 87 Statute 844). In some cases, an environmental assessment or environmental impact statement may be required by the National Environmental Policy Act.

An application to the Corps serves as an application to ADEC for state water quality certification as required under section 401 of the Clean Water Act of 1977 (PL 95-217), and must be reviewed by EPA. The application is reviewed against the Act, the Alaska Water Quality Standards and other applicable state laws. For placing fill in wetlands, water quality stipulations included in the 401 Certification become part of the Corps permit (see ADEC 401 Certification).

The Corps will not issue a permit until consistency requirements for the Coastal Zone Management Act are met and a Coastal Zone Consistency Questionnaire is included with a Corps application. An applicant must certify consistency with the ACMP, and the state Division of Governmental Coordination must, based on the results of the ACMP review, concur. In addition, a review of cultural resources is coordinated with the state's Historic Preservation Office and the federal Minerals Management Service. Archeological or historical data that could be lost or destroyed by the proposed activity is considered and presented in the Corp's final assessment of the described project.

The public interest review (33 C.F.R. § 320.4) considers guidelines set forth under section 404(b) of the Clean Waters Act. The guidelines outline a mitigation sequence that must be followed in the decision-making process, which applies, to all waters, including wetlands. A permit will be denied if the contemplated discharge does not meet the required standards. For placement of fill, the mitigation sequence requires avoiding wetlands where practical, minimizing impact where avoidance is not practicable, and compensating for impact to the extent appropriate and practicable.

A decision to issue a permit, with proposed mitigation measures included, is based upon an evaluation of the probable impacts (including cumulative impacts) of a proposed activity. Benefits that can reasonably be expected to accrue are balanced against reasonably foreseeable costs. Factors relevant to the decision are conservation, economics, aesthetics, general environmental concerns, wetlands, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, property ownership, and in general, the needs and welfare of the people.

8. North Slope Borough

The NSB has adopted a comprehensive plan and land management regulations under Title 29 of the Alaska Statutes (AS 29.40.020-040). These regulations are Title 19 of the NSB Municipal Code and require borough approval for certain activities necessary for exploration and development of lease contracts. The Borough can assert its land management powers to the fullest extent permissible under law to address any outstanding concerns regarding impacts to the area's fish and wildlife species, and habitat and subsistence activities.

The NSBCMP has been incorporated into the ACMP. The program presents policies to regulate activities in the borough's coastal zone. Consistency with the ACMP standards and the policies of the NSBCMP is discussed in Alaska Coastal Management Consistency Analysis Regarding Proposed Oil and Gas Lease Sale 87, North Slope Area-wide, dated August 20, 1997.

9. Other Requirements

Lessees 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 BIA and BLM and obtain approval to enter.

The U.S. Coast Guard has authority to regulate offshore oil pollution under 33 C.F.R. §§ 153-157.

Upon expiration or termination of the lease, paragraph 21 of the lease contract requires the lessee to rehabilitate the lease area to the satisfaction of the state and ASRC. The lessee is granted one year from the date of expiration or termination to remove all equipment from the lease area and deliver up the lease area in good condition.

In addition to existing laws and regulations applicable to oil and gas activities, DO&G requires, under paragraph 26 of the state's standard lease contract, that Sale 87 leases be subject to all applicable state and federal statutes and regulations in effect on the effective date of the lease. Sale 87 leases will also be subject to all future laws and regulations placed in effect after the effective date of the leases to the full extent constitutionally permissible.

Chapter Two: Geography and General Information

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Chapter Two: Geography and General Information

This chapter begins by describing the property and ownership status for the uplands of the Sale 87 area. This is followed by a review of the oil and gas exploration and leasing history and a general description of the petroleum potential of the region, concluding with the current leasing status of the sale. The physical characteristics of the region are then described.

A. Property and Ownership description of the Sale 87 Area

1. Property Description

The Sale 87 area consists of uplands located just south of the Beaufort Sea coast, between the National Petroleum Reserve, Alaska (NPR), and the Arctic National Wildlife Refuge (ANWR) with the Umiat baseline as its southern boundary (see Figure 1.1 and Plate I). This sale area is completely onshore.

The sale area includes the coastal plain of the North Slope of the Brook Range between the Staines and Canning rivers on the east and the Colville River on the west. This region is slightly smaller than the state of Massachusetts, encompassing more than 5 million acres of coastal lowlands, north-flowing braided rivers and streams, lakes, and gently rolling hills and valleys. The southern boundary forms the east-west Umiat baseline located at about 69 degrees, 23 minutes north latitude where ground elevation varies between 500 and 1200 feet above sea level. Elevation throughout the sale area is a key factor in the distribution of plants and animals as described in Chapter Three (AEIDC, 1975:35).

Prominent geographic features include the White Hills and Franklin Bluffs. The Sale 87 also includes portions of numerous rivers, including the Colville, Miluveach, Kachemach, Itkillik, Anaktuvuk, Chandler, Ugnuravik, Sakonowyak, Kuparuk, Toolik, Putuligayuk, Sagavanirktok, Kadleroshilik, Ivishak, Shaviovik, Kavik, Staines, and Canning.

The entire Sale 87 area is within the North Slope Borough (NSB). This home rule borough, incorporated in 1972, extends from the Chukchi Sea to the Canadian border. The borough has the powers of taxation, land management and zoning, and is responsible for providing borough communities with public works, utilities, education, health, and other public services. Following the Sagavanirktok River to the south, the first 60 miles of the Trans-Alaska Pipeline bisects the sale area. The sale area includes lands in the vicinity of the city of Nuiqsut on the Nechelik Channel of the Colville River, and the industrial community of Deadhorse at Prudhoe Bay. Nuiqsut residents rely heavily on the sale area for subsistence resources. Other NSB residents from Kaktovik, Barrow, and possibly Anaktuvuk Pass may travel to the sale area for subsistence.

2. Ownership

The state of Alaska owns the surface of most of the Sale 87 area. Other surface estate owners within the general sale area boundary include Arctic Slope Regional Corporation (ASRC), City of Nuiqsut, the North Slope Borough, the federal government, and many Native allottees. The state of Alaska owns most of the subsurface estate beneath the sale area. Other parties with mineral interests in the sale area include ASRC and Kuukpik Corporation.

Ownership status for some lands offered for leasing has either not been determined or is disputed. The issue involves mineral interests and control over some uplands within the NPR portion of the sale area. The disagreement is between ASRC and Kuukpik Corporation, and involves a key property right to the use and development of the subsurface estate (See sub-section 1, "Subsurface Estate" below).

The Alaska Statehood Act allowed the state of Alaska to select from the federal public domain 102.5 million acres of land as an economic base for the new state. The Act also granted to Alaska the right to all minerals underlying these selections and specifically required the state to retain this mineral interest when conveying interests in the surface estate. ANCSA, passed by Congress in 1971, allowed newly created Regional Native Corporations to select and obtain from the federal domain lands including the surface and subsurface estates within native corporation boundaries as an economic base. It also allowed for Native Village corporations and individual Native Alaskans to receive surface estate interests in land for their economic benefit. The surface estate of the uplands in the Sale 87 area fall into one of three ownership categories: land owned by the state of Alaska, land owned by ASRC, the Kuukpik Village Corporation (Nuiqsut), and land owned by Native Allottees.

a. Arctic Slope Regional Corporation Agreement

The subsurface estate within the portion of Sale 87 located within the Colville River Delta is jointly owned by the state and ASRC, the Regional Native Corporation for the North Slope. The joint ownership is the result of an agreement between the state and ASRC which was signed December 17, 1991, and approved by the legislature and became effective on May 27, 1992.

The agreement settled a long-running legal dispute concerning North Slope mineral ownership near Nuiqsut and Point Lay resulting from a 1974 agreement in which ASRC and the state agreed to exchange lands near Nuiqsut and Point Lay. Under the 1991 settlement, the state and ASRC agree to jointly own undivided interests in certain minerals (including oil and gas) in the mineral estate of disputed lands. The settlement also grants the state the executive right to hold oil and gas lease sales jointly for itself and ASRC.

If such lands are leased, the state and ASRC separately administer the lease with respect to its own undivided interest in the subsurface (the lessee must obtain a permit or approval from both the state and ASRC). The two parties have what is essentially an identical but separate relationship with the lessee with respect to the same mineral estate. Although such mineral cotenancies (possession of a unit of property by two or more persons) are unusual in Alaska, this is a frequent occurrence in other states, like Texas, where land ownership is more complicated. The agreement involves only the mineral estate; it does not change the surface ownership. The surface of the uplands within the agreement area near Nuiqsut is owned by the village corporation for Nuiqsut, Kuukpik Corporation, and by individual Native allotment holders. The subsurface estate beneath the tide and submerged lands, and bed of the Colville River within the sale area are also jointly owned by the state and ASRC.

Under the settlement agreement, the state does not give up any of its duties to the public imposed by law. The state still must determine whether a sale would be in the best interests of the state, and must follow relevant substantive and procedural requirements for leasing and for permitting subsequent exploration, development and production. The state retains all rights under state law to ensure that development activity on leased tracts complies with laws governing natural resource management and protection.

i. Subsurface Estate

Portions of the Sale 87 area are located within NPRA, and may also be subject to a 1987 land selection consent agreement between ASRC and the Kuukpik Corporation (Nuiqsut village). In that agreement these parties consented and agreed as follows:

- (1) Kuukpik hereby gives its concurrence for ASRC to exercise its option under 1431(o) of ANILCA to acquire the ASRC Subsurface, but Kuukpik expressly conditions its concurrence in such acquisition of the ASRC Subsurface by reserving the right to consent to any Exploration and Development Activities that ASRC, its successors and assigns, may engage in from time to time with respect to the ASRC Subsurface.
- (2) ASRC agrees that it will not engage in any Exploration and Development Activities with respect to the ASRC Subsurface without first obtaining the consent referred to in paragraph 1 of this agreement.

ASRC received title to these lands subject to this agreement. The state of Alaska received its undivided interest to the subsurface estate beneath these lands from ASRC in 1992, 1993, and 1994. The

state's title and leases issued on these lands are, therefore, also subject to the 1987 ASRC-Kuukpik Agreement.

ii. Surface Estate

With the exception of the bed of the Colville River, which is owned by the state, the surface estate of the uplands within the Colville River Delta portion of the Sale 87 area falls into one of two ownership categories: land owned by the Kuukpik Village Corporation (Nuiqsut), and land owned by Native Allottees. Kuukpik village land also breaks down into lands within and outside of NPRA.

Village Owned Lands outside of NPRA: The Alaska Native Claims Settlement Act, (ANCSA) allowed the Village of Nuiqsut (Kuukpik Corporation) to select and acquire lands in the Colville River Delta. Of Kuukpik's total entitlement of 115,000 acres (five townships), approximately 70,000 acres (three townships) could be selected outside of NPRA on lands that had been tentatively approved for conveyance to the state of Alaska. Under provisions of ANCSA, ASRC was allowed to acquire the subsurface estate beneath these lands. The 1974 Agreement between Kuukpik, ASRC, and the state of Alaska and the 1992 Settlement Agreement between ASRC and Kuukpik provided for the right of access to Kuukpik's surface. ASRC and the state of Alaska, their successors, assigns, and lessees were allowed to conduct oil and gas activities on Kuukpik's lands east of NPRA under the provisions of the 1992 Settlement Agreement, the lease, and, to the extent applicable, the requirements of AS 38.05.130.

Village Owned Lands inside of NPRA: In order to fully satisfy its land entitlement under ANCSA, Congress allowed Kuukpik to select certain lands within NPRA. Section 1431(o) of Alaska National Interest Lands Conservation Act, (ANILCA) allowed ASRC an option to acquire the subsurface estate beneath these village lands, provided that the village corporation concurred. In 1987, Kuukpik conditionally concurred to ASRC's acquisition of these subsurface interests. ASRC subsequently conveyed an undivided ownership interest to certain sections of these lands, located along the Nechelik Channel of the Colville River, to the state of Alaska under the 1991 Settlement Agreement between the state of Alaska and ASRC, (see above). In January 1996, ASRC initiated a lawsuit in federal court seeking a declaratory judgment that Kuukpik's consent rights under Section 1431(o) of ANILCA, the 1987 consent agreement and Section 14(f) of ANCSA do not constitute an absolute veto over exploration and development of ASRC's subsurface in NPRA, and that Kuukpik's consent may not be unreasonably withheld. The federal court has recently ruled that the lawsuit lacks federal jurisdiction and an order dismissing the case is forthcoming. No other litigation has been initiated and the dispute remains unsettled.

Should these jointly-owned lands within NPRA be offered and leased, the lessee may not exercise its access rights to the Kuukpik owned surface until the lessee makes provisions to compensate the landowner for all damages sustained by reason of entering upon the land as required by the lease, and, to the extent applicable, the requirements of AS 38.05.130 as required in the terms of the lease.

Copies of the 1974 Agreement, the 1991 Settlement Agreement between the state of Alaska and ASRC (which includes the 1987 ASRC-Kuukpik Agreement), and the 1992 Settlement Agreement between Kuukpik and ASRC will accompany the lease for any of the tracts to which the agreement applies. Copies of all agreements are available for review in the DNR's Public Information Center, Suite 200 in the Frontier Building, 3601 C Street, Anchorage Alaska, and are also available from DO&G on request.

Native Allotments: The surface estate to certain lands within the Sale 87 area are owned by Native allottees. Should these jointly-owned lands be offered and leased, rights to exploration and development of the oil and gas resources may not be exercised until the lessees make provisions to compensate the landowner for all damages sustained by reason of entering upon the land as required by the lease, and, to the extent applicable, the requirements of AS 38.05.130.

B. Exploration History of the North Slope and Beaufort Sea

Oil seeps have long been known to the Eskimos of the North Slope. Oil shale was used for fuel by early Eskimos according to archaeological evidence. Early traders reported seeps along the coast. The first geologic and topographic studies date back to 1901 and the first formal descriptions were recorded by the U.S.

Geological Survey in 1919. By 1921, prospecting permits were filed and in 1923 President Harding, established by executive order, the Naval Petroleum Reserve No. 4 (NPR-4). The NPR-4 is also known as National Petroleum Reserve-Alaska (NPRA). The Geological Survey conducted reconnaissance mapping from 1923 through 1926 and published the results in 1930 (Jamison et al, 1980:290; AEIDC, 1975:83).

The first exploration phase of NPR-4 ended in 1953. Between 1923 and 1953, the United States Navy drilled 37 test wells and found three oil accumulations and six gas accumulations within the reserve. Only two of these discoveries were considered sizable, namely Umiat, with an estimated 50 million barrels of recoverable oil, and Gubik, with an estimated 600 billion cubic feet of recoverable gas (Kornbrath, 1995:14). Gas from another of the discoveries, the small South Barrow gas field, is being produced today for local consumption at Barrow.

BLM opened North Slope lands for competitive bidding in 1958 when 16 thousand acres were offered in the area of the Gubik gas field. That same year BLM opened four million acres in an area south and southeast of NPR-4 for simultaneous filing and subsequent drawing. From 1962-1964 industry exploration programs expanded rapidly. During this period, Sinclair and British Petroleum drilled a total of seven unsuccessful wildcat wells in the arctic foothills (Jamison et al, 1980:292).

In 1964, under the Statehood Act, the state of Alaska selected some 80 townships across the northern tier of lands between the Colville and Canning Rivers and received tentative approvals on the 1.6 million acres from the federal government in October of the same year. In December 1964, the state held the 13th State Competitive Sale (the first on the North Slope) of leases covering 625,000 acres in the area east of the Colville River Delta. In July 1965, the state held the 14th State Competitive Sale which included the onshore area in the vicinity of Prudhoe Bay. In the 18th State Competitive Sale, held in January 1967, the offshore Prudhoe Bay tracts were offered and leased (Jamison et al, 1980:292-294).

Following the succession of dry holes in the arctic foothills, exploration shifted northward to the central coastal area. In 1965, the first holes drilled in the area immediately surrounding the Prudhoe Bay structure came up dry. In January 1967, in what was essentially a last ditch effort, a rig was moved to the Prudhoe Bay State No. 1 location near the mouth of the Sagavanirktok River. Twelve months later the discovery of the Prudhoe Bay oil field was announced (Jamison et al, 1980:290; AEIDC, 1975:83). Prudhoe Bay Field began production in 1977, and is currently estimated to have originally contained in excess of 12 billion barrels of economically recoverable oil (Figure 2.1), making it the largest oil field ever discovered in North America.

Following the Prudhoe Bay discovery, exploration activity increased dramatically. Thirty-three exploration wells were completed in 1969 as industry prepared for the Lease Sale 23 in September of that year. The state offered 413,000 acres along the Arctic coast between the Canning and Colville rivers and earned over \$900 million in bonus bids on 164 tracts (Weimer, 1986:32; Jamison et al, 1980: 291). This was the last lease sale on the North Slope until the Joint Federal-State sale in December 1979. After the discovery of the Prudhoe Bay field and before the 1979 joint sale, over 100 exploratory wells were drilled on the North Slope, with 19 of those wells discovering oil or gas.

Figure 2.1 North Slope Fields and Announced Discoveries

In 1974, spurred by the OPEC oil embargo of 1973, the federal government began a second large exploration program in NPRA. Between 1974 and 1981, the United States Geological Survey (USGS), drilled a total of 27 test wells within NPRA. Other than two gas fields which are currently being produced to supply Barrow, no commercial deposits were discovered by this program. The two currently producing fields are the Walakpa Field, which contains an estimated 142 billion cubic feet of economically recoverable gas (Imm, per comm., 1996), and the East Barrow Field, which contains an estimated 13 billion cubic feet of economically recoverable gas (Kornbrath, 1995:12). In 1980, Congress authorized competitive leasing within NPRA. From 1982-1984, four lease sales were held. A total of over 1.3 million acres were leased in the first three sales, generating over \$84 million in total bonus bids. The final sale received no bids. Only one industry well was drilled on a lease acquired in these sales. This well, the ARCO Brontosaurus No. 1, was completed, plugged and abandoned in 1985.

The recent discovery of a giant oil field on the border of NPRA demonstrates that the area contains significant potential for the discovery of commercial oil and gas accumulations. In 1994, ARCO and partners discovered the Alpine accumulation on state and native corporation land along the Colville River and adjacent to the northeastern boundary of NPRA. In 1996, ARCO announced plans to develop the field which in the most recent estimate, contains 365 million barrels of economically recoverable oil (PNA, 1997). Development of this new oil field may generate renewed interest in the oil and gas potential of NPRA by both industry and government.

Since the 1979 Joint Sale, five federal lease sales have been held in the Beaufort Sea, and there have been 28 state lease sales offering both onshore and submerged Beaufort Sea acreage. To date 31 exploratory wells have been drilled in the federal waters of the Beaufort Sea resulting in five discoveries. These discoveries are Seal Island/Northstar, Kuvlum, Hammerhead, Sandpiper, and Tern Island/Liberty. To date, exploration wells drilled on North Slope state leases have resulted in 26 discoveries.

It is not surprising that many of these accumulations were found in the vicinity of Prudhoe Bay where the density of wells and seismic control is the highest and the geologic conditions optimal. At least eight of these post-Prudhoe Bay discoveries are currently producing oil because of the Prudhoe Bay infrastructure and their relatively close location to the Trans-Alaska Pipeline. Six of these, Lisburne, Kuparuk, Milne Point, Endicott, Niakuk, and Point McIntyre are major fields (Table 2.1). While initial production on the North Slope was from onshore areas, four fields produce at least some of their reserves from offshore areas, these fields are Endicott, Point McIntyre, Milne Point and Niakuk. In addition, British Petroleum has announced plans to produce the Northstar Field totally from offshore facilities (PNA, 1996).

Table 2.1 Major Producing Fields on the North Slope and in the Beaufort Sea

Field Name	Discovery Date	Production Began	Estimated Original Economically Recoverable Oil (MMBBL)	Estimated Original Economically Recoverable Gas (BCF)
Prudhoe Bay	1967	1977	12,219	28,203
Lisburne	1967	1981	145	362
Kuparuk	1969	1981	2,627	998
Milne Point	1969	1985	395	23
Endicott	1978	1987	622	987
Niakuk	1985	1994	66	34
Pt McIntyre	1988	1993	358	329

Source: ADN 1996:22; Kornbrath 1995:17

Fields proposed for development, but not yet producing, include Badami, Northstar, Alpine, Liberty, Tarn, and West Sak. Conoco discovered the Badami field in 1991. It is located onshore near Mikkelsen Bay and has estimated economically recoverable reserves of 100 million bbl of oil (PIC, 1996). The Northstar field, owned by BP is estimated to contain 145 million barrels of economically recoverable oil, and is expected to come on-line around by 1999 (ADN, 1997b). The field is located offshore about six miles northwest of Prudhoe Bay.

In October of 1996, ARCO Alaska, Anadarko Petroleum Corporation, and Union Texas Petroleum Alaska Corporation, announced plans to develop the Alpine field in the Colville River area west of the Kuparuk oil field. Production is anticipated to begin by the year 2000 (PNA, 1997). The Liberty field is located on federal leases approximately five miles offshore in the Beaufort Sea, northwest of the Badami field. BP owns the lease and estimates there is 120 million barrels of recoverable oil. Production probably will begin in 2000 (ADN, 1997a). The Tarn prospect, owned jointly by ARCO and BP, is located southwest of Kuparuk and contains estimated proven and potential reserves of 50 million barrels. Production is expected to begin by late 1998 or early 1999 (Petroleum News Alaska, 1997)

Low-gravity oil sands (west Sak and Ugnu) were discovered in the Kuparuk River area in 1969. The West Sak alone contains an estimated 16 billion barrels of oil in-place and combined estimates for the West Sak and Ugnu are as high as 40 billion barrels in-place (Weimer, 1986:34). ARCO plans to start up production of the West Sak in 1997 and has estimated that the initial start-up area contains 300-500 million barrels of economically recoverable oil (ADN, 1996b). Similar low gravity sands are in production at the Milne Point Field where the combined production from 14 wells produces an average of about 3000 barrels of oil per day (PIA, 1995).

In 1997, BP and Chevron announced the discovery of the Sourdough field next to ANWR. Current information indicates Sourdough could contain 100 million barrels of recoverable oil. Further exploration is needed before determining whether to develop the field. The Sourdough project would require up to 35 miles of pipeline to link up with the Badami field to the west (Peninsula Clarion, 1997). ARCO drilled the Warthog prospect in the winter of 1997. The well is located in Camden Bay off the coast of ANWR. ARCO plugged and abandoned the well in December 1997. The results are confidential, and ARCO is currently evaluating its findings. (Lee, 1998).

Most recently, in February 1998, Arco, BP, and Exxon announced the discovery of two new oil accumulations, Sambucca and Midnight Sun, during the drilling of a Prudhoe Bay "satellite"¹ prospect. Test production from the discovery is planned for the first half of 1998.

C. Petroleum Potential

Sale 87 encompasses a vast and diverse area, which makes it difficult to assign an overall petroleum potential. ADNR has determined the petroleum potential to be low to moderate, with the potential generally increasing from south to north. Determining the petroleum potential involves the evaluation of several elements including geology, geophysics, and exploration history of the area.

For an accumulation of hydrocarbons to be recoverable, the geology must be favorable. This may depend on the presence of source and reservoir rock; the depth and time of burial; the presence of migration routes and geologic traps or reservoirs and the timing of fluid movements from source to trap. Source rocks are organic rich sediments, generally marine shales, which have been buried for a sufficient time, and with sufficient temperature and pressure to form hydrocarbons. As hydrocarbons are formed, they will naturally progress toward the surface if a migration route exists. An example of a migration route might be a permeable layer of rock in contact with the source layer, or fractures which penetrate organic rich sediments. A hydrocarbon reservoir is permeable rock that has been geologically sealed at the correct time to form a "trap." The presence of migration routes therefore affect the depth and location where oil or gas may pool and form an accumulation.

For a hydrocarbon accumulation to be economically producible the reservoir rock must have sufficient thickness, good porosity—number of pore spaces per volume, permeability—a rock's capacity for transmitting a fluid, and hydrocarbon volume or fill. The North Slope has all these favorable geologic conditions and, considering the exploration history of the area, the chances of finding undiscovered petroleum reservoirs are very good. Proximity to the collection, processing, and distribution network, however, directly affects the economic field size limit for an oil accumulation. Whereas accumulations in the order of a few tens of millions of barrels are considered economic to develop in the vicinity of the existing oil fields, accumulations need to be on the order of hundreds of millions of barrels to be considered economic in the

¹ A satellite is an oil and gas accumulation in and around a principal field such as Prudhoe Bay that is not part of the main reservoir.

more remote areas of Sale 87. Proximity and the resultant economic field size limit generally skews the petroleum potential to be low in the more remote southern portions of the sale area. It is anticipated that the remaining undiscovered accumulations are expected to be near or below the economic size limit. In light of these factors, ADNOR considers the petroleum potential of the sale area to generally increase from low in the southern portion to moderate in parts of the northern portion.

The process of evaluating the oil and gas potential for state lease sale areas, such as the North Slope, involves the use of data, including seismic and well information which by law the division must keep confidential under AS 38.05.035(a)(9)(C). In order to protect these data, the division must generalize the assessment which is made public.

D. Physical Characteristics of the Sale 87 Area

1. Geology

Northern Alaska is made-up of three distinct geologic regions: the Brooks Range, the Arctic Foothills, and the Arctic Coastal Plain (Moore, et al., 1994). The sale area is located in the center of the Arctic Coastal Plain, and rock sequences with known petroleum potential underlie the entire region. The rocks under the sale area are exposed at the surface in the Brooks Range. Rock sequences are formed by geologic events and are often described in terms of the time period during which they were formed (see Table 2.2).

Table 2.2 Geologic Time and Formations

Eras	Periods	Epochs	Began Approximate Number of Years Ago
Cenozoic	Quaternary	Holocene (Recent)	10,000
		Pleistocene (Glacial)	1 million
	Tertiary	Pliocene	7 million
		Miocene	25 million
		Oligocene	40 million
		Eocene	60 million
Mesozoic	Cretaceous Jurassic Triassic	Paleocene	68-70 million
		Upper & Lower	135 million
			180 million
Paleozoic	Permian Pennsylvanian Mississippian Devonian Silurian Ordovician Cambrian		225 million
			270 million
			325 million
			350 million
			400 million
			440 million
	500 million		
	600 million		

Source: Webster's Ninth New Collegiate Dictionary, 1991:512 and AEIDC, 1975:37

The Brooks Range consists of east-west trending mountain groups that reach heights in excess of 6000 feet. Rocks of pre-Mississippian age (350 million + years) to Tertiary age (7 million + years) are exposed due to extensive uplift, folding and faulting. There is little to no oil and gas potential in the Brooks Range because of this extensive deformation and uplift, however these pre-Mississippian to Tertiary age rocks are studied by petroleum geologists, because they do contain petroleum where they occur beneath the sale area.

The Arctic Foothills is a narrow province between the Brooks Range and the Arctic Coastal Plain, consisting of a series of rolling hills, mesas, and east-trending ridges that descend from 1,500 to 900 foot elevations. The rocks in this area are less deformed and younger than those to the south.

The Arctic Coastal Plain contains surface sediments which were formed by fluvial (moving water) and deltaic deposition. These sediments are relatively uniform sandy silts (Craig, et al., 1985). The coastal

plain is underlain by the Colville Basin; a large east-west trending foreland basin of Cretaceous (135 million + years) to Tertiary age (7 million + years). The subsurface geology of this area and the history of previous petroleum production and exploration makes it the most prospective area for hydrocarbons in northern Alaska.

The history of rocks beneath the Sale 87 area is marked by periods of continental rifting, mountain building, and sedimentary deposition. This history is marked by four distinct geologic sequences of rocks with each having a unique sediment source area, depositional environment, and structural character. As these major rock sequences were being formed relatively smaller scale events, such as changes in sea level, altered the depositional environment and created additional internal complexities. The four major rock sequences from oldest to youngest (the oldest rocks are the deepest) are: the Franklinian, Ellesmerian, Rift, and the Brookian. The order of events in the evolution of the area geology were (see Figure 2.3);

1. A stable early Arctic Continental Platform before Devonian time,
2. Onset of continental rifting with uplift to the north of this stable Arctic platform and deposition of sediments southward; and
3. Continued rifting, uplift, and termination of deposition from the north, along with uplift of the Brooks Range and deposition of sediments from the south onto the Arctic Coastal Plain.

The oldest rock sequence, the Franklinian, may have once been a stable arctic continental platform before middle Devonian time (about 400 million years ago). This sequence is also referred to as the pre-Mississippian sequence, because of a lack of continuous geologic information. The Franklinian sequence contains a wide range of rock types that include volcanics, granites, carbonates, and metamorphosed argillites. Due to its geology and tectonic history, the Franklinian sequence is considered to have low petroleum potential (Richter, 1997).

During middle to late Devonian time, a mountain building and rifting event uplifted the Franklinian sequence, deforming and metamorphosing the rocks in the process. Sediments from the uplifted Franklinian sequence spread southward into the large arctic basin (epicontinental shelf). This process continued through to late Cretaceous time. These northerly-sourced sediments formed the Ellesmerian Sequence (Moore, et al., 1994).

The Ellesmerian Sequence is the most important geologically in terms of petroleum production. Formations within the Ellesmerian Sequence form the primary petroleum reservoirs at Prudhoe Bay, and Endicott. The Ellesmerian Sequence contains marine carbonates and quartz and chert rich clastic rocks, representing about 150 million years of deposition (Mississippian through Triassic). From the center of the Colville Basin, the Ellesmerian thins to the south due to depositional distance from its source and it thins to the north due to subsequent uplift and erosion (Moore, et al., 1994).

Rifting of the continental mass dominated the geology by the end of the late Jurassic to late Cretaceous periods. The northern continental source for the Ellesmerian sediments supplied less and less sediment to the arctic basin as time passed. Uplift and faulting of the Franklinian and Ellesmerian sequence formed fault blocks and grabens (low areas between fault blocks). These grabens were filled by sediments from the locally uplifted or upfaulted Ellesmerian and Franklinian sequences, forming the Rift Sequence (Craig, et al., 1985). It is also at this time that the Barrow Arch formed along the present day Beaufort Coast. Sedimentation from the north eventually ended sometime in the Late Cretaceous and the following period of non-deposition along with continued uplift along the Barrow Arch created a regional Lower Cretaceous Unconformity (LCU) which becomes angular approaching the Barrow Arch from the south. To the north of the Barrow Arch the Ellesmerian sequence is absent. The LCU is an important migration and accumulation element for most of the oil fields on the North Slope, including Prudhoe Bay (Jamison, et al., 1980).

Figure 2.3 Evolution of North Slope Geology

To the south, compressional forces in the Jurassic to early Cretaceous caused thrust faulting in what is now the Brooks Range. Sediments from the thrust faulted blocks in the Brooks Range poured into the Colville Basin, progressively filling it from the south, forming the Brookian Sequence. Brookian sediments filled the Colville Basin and spread out over the Barrow Arch and onto Alaska's continental margin during the upper Late Cretaceous through Tertiary time. Petroleum accumulations in the Brookian Sequence are found throughout the North Slope basin, including at West Sak, Schrader Bluff, Flaxman Island, and the Outer Continental Shelf (OCS) accumulation at Hammerhead (Weimer, 1987).

Onshore present day geology of the sale area is, in general, comprised of a thick section of unconsolidated Quaternary sediments (Brown and Kreig 1983), deposited within the last 1 million years. These sediments are probably of the Gubik Formation which unconformably overlies the weakly cemented sediments of the upper Brookian Sequence. Most Quaternary deposits are unconsolidated sand and gravel composed of reworked Brookian sediments, along with materials from the present day Brooks Range. Overlying these deposits are ice-rich silts and sandy silts (1.5 m to 2.5 m thick at Prudhoe Bay) that include variable amounts of organic matter, which are deposited by the numerous rivers on the North Slope. In addition to these fluvial deposits are local areas of eolian deposits (sand dunes) derived from river silts (Brown and Kreig, 1983) For more on surface deposits and soils of the Sale 87 area, see sub-section D.3 of this chapter.

2. Climate

The entire sale area is within the Arctic climate zone of Alaska. Surface conditions in the Arctic vary dramatically from year to year and day to day. In summer, the climate is generally mild. The three-month ice-free season is critical to biological productivity. In contrast, winters are severe, forcing many species to migrate south.

a. Precipitation

Precipitation throughout the sale area varies with location. Heaviest rain and snow falls occur in higher elevations. Along the Beaufort Sea coast, the amount of precipitation is low. Air temperature controls how much moisture the air holds as a vapor. Extremely cold air can contain only very small amounts of water vapor. The result is low precipitation. Therefore, the region is classified as a desert—a desert of frozen land (AEIDC, 1975:18). Most precipitation occurs during summer as rain. Average annual snowfall is only 12 inches along the coast (AEIDC, 1975:18). Average annual snowfall in the eastern Brooks Range is estimated as high as 100 inches, whereas along the northwest coast, it averages 12 inches. Umiat, at the southern boundary of the sale area receives an average of 5.71 inches of precipitation and 33.2 inches of snowfall each year. In contrast, Oliktok Point along the Arctic coast receives an average of 5.39 inches of precipitation and 18.8 inches of snowfall each year (AEIDC, 1975:18). In the Nuiqsut-Prudhoe Bay area, precipitation averages 5 inches with an annual snowfall of 20 inches. Anaktuvuk Pass, located outside of the sale area and deep in the Brook Range receives an average of 10.65 inches of precipitation and 63 inches of snowfall annually (ADCRA, 1996).

b. Temperature

The Arctic receives most of its heat energy during the short summer months. The decrease of heat energy in fall and winter is gradual at southern latitudes, but is dramatically rapid at extreme northern latitudes. Areas of extensive cloud cover receive much less heat energy. The length of the day is also a factor, since longer days produce more radiation. The sun angle in the Arctic is low even during long days. As a result, the sun's rays pass through more atmosphere which absorbs some of the energy before it reaches the surface. Although the Arctic Ocean and Beaufort Sea are frozen for 10 months of the year they have a modifying effect on coastal temperatures. February is the coldest month throughout the Arctic with the exception of Anaktuvuk Pass, where January is coldest. Average minimum temperatures range from -25° F along the coast to minus -35° F along the foothills of the Brooks Range. July is the warmest month with average maximum temperatures in the 40's along the north coast to mid-to-low 60's along the foothills (AEIDC, 1975:15). Throughout a given year, temperatures in the Nuiqsut-Prudhoe Bay area can range from -56 to 78 degrees F. In contrast, the climate of Anaktuvuk Pass has a strong continental influence with temperatures ranging from -14 to 50 degrees (ADCRA, 1996).

c. Winds

A semi-permanent area of high pressure is centered approximately 600 miles north of the Alaska arctic coast. Air continually flows south from this area of higher pressure as a north wind. By the time it reaches the Beaufort Sea coast its direction is between northeast and east because of the rotation of the earth (AEIDC, 1975:19). Wind direction is predominately easterly but shifts to westerly from January to April. Part of this shift is due to piling up of air against the Brooks Range. Sea breezes (air moving inland in response to unequal heating across the coastline) control at least 25 percent of the summer surface wind direction and extend to at least 20 offshore (MMS, 1996: III-A-3)(Kozo, 1984:33).

Surface wind speeds along the coast are persistent and strong compared to those in the south. Coastal wind speeds of 30 to 50 knots are common along the coast during winter months, while calm conditions are more common to the south. Barrow experiences calm winds only one percent of the time, while the winds are calm at Barter Island about four percent of the time, and at Umiat about 17 percent. The average annual wind speed is 10.6 knots at Barrow and 11.5 knots at Barter Island. Wind direction is predominantly easterly along the coast and is divided equally between east and west at Umiat. (AEIDC, 1975:19).

Surface wind conditions affect nearshore currents, the movement of ice floes and oil spills, and the formation and break-up of sea ice. Winds also influence the timing of migratory activity in animals, including arctic fishes, and the relative safety of subsistence harvesting and oil and gas activities in the Arctic (Kozo, 1984). Strong winds produce extensive coastal erosion, and can cause structural damage to buildings. Arctic winds also blow snow and cause whiteout conditions, making surface navigation across the flat, horizon-less coastal plain nearly impossible. Strong winds also severely restrict aircraft travel in the sale area (AEIDC, 1975:19).

3. Hydrology and Soils

The southern half of the sale area lies in the northern foothills of the Brooks mountain range. These foothills are characterized by irregular buttes, knobs, mesas, east-trending ridges, and intervening, rolling tundra plains. Most streams east of the Colville River are braided with large gravel flats. The Arctic coastal plain west of the Colville River is flat with occasional pingos and a section of active and stabilized sand dunes which rise as high as 40 feet above the plain. East of the Colville River, the White Hills and Franklin Bluffs provide some topographic relief above the plain. The combination of extensive flat terrain, and a continuous layer of permafrost beneath a shallow active permafrost layer result in poorly drained soils and marshes throughout the northern portion of the sale area (AEIDC, 1975:56).

a. Soils

Major river corridors of the Colville, Kuparuk, Sagavanirktok, Shaviovik and Canning are underlain by unconsolidated alluvial (stream laid) deposits. These deposits are coarse-grained, generally well-drained, not frost-susceptible, provide good foundation material, and are relatively easy to excavate. The uplands between these rivers are overlain by coastal plain deposits. These deposits include both coarse and fine-grained material, and have generally high silt content, especially near the surface. Coastal plain deposits generally are poorly drained, high in ice content, difficult to excavate, and are frost-susceptible making them less suitable for foundation material. In the southern portion of the sale area, Tertiary age bedrock is exposed in the White Hills, Franklin Bluffs, and in the rolling hills to the west of the Canning River. Organic surface material, called peat, is distributed throughout the sale area and provides the bedding to support the tundra mat above. Peat is poorly drained, contains a high content of ice or water, and is commonly removed or filled over prior to construction (AEIDC, 1975:64). Wind-blown silts may form thin layers mixed with or underlying the peat layer (AEIDC, 1975:60).

Permafrost consists of any soil or other superficial deposit, including bedrock, that has been colder than 0° C for two or more years. Permafrost soils may be nearly ice free in coarse, unsaturated materials and may contain more than 50 percent water in finer grain saturated soils. Alaska has two types of permafrost classified as continuous or discontinuous. Continuous permafrost implies that the ground is frozen over nearly all the landscape and is colder than -5° C at the depth below annual seasonal temperature changes (depth varies based on rock type and water content, but is about 15 m). Discontinuous permafrost is ground that is between 0° C and -5° C and as the term suggests, is not continuous. In discontinuous zones of permafrost,

ground on south facing slopes and under large bodies of water are usually not frozen. Generally north of Atigun Pass (crest of the Brooks Range), the permafrost is continuous (Brown and Kreig, 1983). Heading offshore the permafrost becomes progressively more discontinuous (MMS, 1996).

Near Prudhoe Bay, permafrost extends to a depth of about 600 m which is the probable case for most all of the onshore sale area (Brown and Kreig, 1983) (Combellick, 1994, citing to Collett and others 1989). The depth of the active layer, or the layer of seasonal thaw is generally less than 0.9 m and 1.8 m beneath active stream channels. Ice content varies from minor segregated ice to massive ice in the form of ice wedges and pingos. Permafrost, like coastal winds, shallow gas deposits, and earthquakes, are geophysical phenomena which may pose hazards to oil and gas operations (see Chapter VI).

b. Hydrology

The summer season on the Arctic coastal plain is initiated by extensive Spring flooding along the coastal margin. The heaviness of this flooding varies from year to year and depends on factors such as amount of upland snow accumulation and the timing of river ice and sea ice break-up. The speed, direction, and persistence of summer winds determine whether freshwater river runoff accumulates or dissipates in the nearshore waters of the Beaufort Sea. This brief, but heavy seasonal flood breaths life into all habitats of the sale area after a long dormant winter. River deltas are made up of major and minor channels, and numerous oxbows and lakes. These river deltas, especially the Colville, provide important migrating, spawning, feeding and overwintering habitat for arctic fish (see Chapter Three). The river systems of the sale area also provide important habitat for many species of birds, like Peregrine Falcon, and migratory and feeding habitat for caribou, bear, wolf, and foxes. Additionally, subsistence harvesting is heavily dependent on the productivity and species diversity of the rivers, streams, and lakes of the North Slope.

Numerous lakes in the sale area are formed by thermokarst (freeze and thaw) processes. Thermokarst topography consists of mounds, sink holes, tunnels, caverns, short ravines, lake basins, and circular lowlands. Melting of the underlying permafrost creates settling of the soil, resulting in depression features, such as thaw lakes. On the Arctic coastal plain, thaw lakes are elongated and oriented on a north-northeast axis by prevailing wind patterns. Thaw lakes cover more than half of the total surface area of the plain. In the southern portion of the Sale 87 area, lakes are less oriented and are fewer in quantity.

Across the coastal plain, ground-surface depressions cause pooling of water in summer. This pooling causes the underlying permafrost to melt. Thaw continues along lake margins, extending the lake which may merge with other thaw lakes. Eventually, thaw extension of the lake continues until higher ground is breached and the lake is drained through an outlet channel. Some thaw lakes are connected to river channels while others are not. Drained lakes leave behind a marshy depression surrounded by a ridge of surface material (residual), formerly the lake margin. The initial surface residuals rise 10 to 15 feet above the adjacent drained basins and cover about twenty-five percent of the land surface on the coastal plain (AEIDC, 1975:68).

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Chapter Three: Habitat, Fish and Wildlife

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Chapter Three: Habitat, Fish and Wildlife

A. Habitats

Habitats which support natural resources of the sale area include the coastal zone, arctic plain, and northern foothills of the Brook Range. Freshwater streams and lakes, aquatic plants, wetlands, tussock meadows, and riverine corridors provide species higher up in the food chain with essential nutrition and shelter. Important fish and wildlife species which depend on habitats of the Sale 87 area are described in section B of this Chapter.

1. Coastal Zone

Nearly half of the Sale 87 area is located within the coastal zone where activities are subject to the North Slope Borough Coastal Management Program (DGC, 1985). The boundary of the coastal zone extends inland approximately 25 miles (DGC, 1985). To protect fish spawning and overwintering habitats, the coastal zone also includes certain river corridors, including the Colville, Miluveach, Itkillik, Anaktuvuk, Chandler, Sagavanirktok, Shaviovik, Kavik, and Canning (NSBCMP 1984b)

Along the Beaufort coast, adjacent to the Sale 87 boundary, salt water dependent habitats merge into freshwater habitats. Saltwater intrudes in soils and ground water flows. Coastal vegetation is influenced by sea spray; on average as far as two to three miles inland. Stream slope and freezing action in winter generally determine the distance at which saltwater reaches upstream (DGC, 1985).

The coastal zone supports optimum waterfowl and shorebird nesting habitat, caribou calving and feeding grounds, and polar bear denning sites. The coastal zone is indirectly influenced by activities outside of the sale area. For example, caribou wintering in the Brooks Range are influenced by the availability of food in their preferred summering habitat on the Arctic coastal plain (DGC, 1985). The coastal zone provides important spawning habitat for marine fish and invertebrates. These creatures in turn provide waterfowl and marine birds with a plentiful source of food (DGC, 1985). All rivers flowing into the Beaufort Sea, and the inland extent of anadromous fish populations host species that are indirectly influenced by the coastal zone. At a minimum, the coastal zone includes the extent of coastal wet tundra habitat; a range roughly corresponding to the 200 foot contour (DGC, 1985).

The tundra surface is marked by lakes, thaw ponds, frost cracks, and polygonal ground formations. Successive freezing and thawing of moisture laden soils causes frequent draining and reforming of lakes and surface peat. The soil beneath tundra freezes each winter, thaws in spring, and is saturated with salt or fresh water throughout the summer. The freeze-thaw process causes these lakes to reform each year. Tundra and grasses of the barrier islands are also exposed to freeze-thaw processes (AEIDC, 1975:36).

The vegetation habitats of the Sale 87 area can be roughly divided into two ecoregions; the Arctic plain and the Arctic foothills. Additionally, across the North Slope and throughout the sale area, wetland habitats and their characterization are of key interest to scientists, ecologists, government, and industry.

2. Arctic Plain

The distribution of vegetation types on the Arctic plain is strongly associated with microtopographic features which affect soil drainage. Wet soil conditions support wet graminoid herbaceous communities dominated by sedges or grasses. Dwarf scrub communities grow where soil conditions are dryer, such as at thaw lake margins, along river bluffs, or other more elevated areas which provide a rooting zone above the standing water table (USGS, 1995).

Most sedge communities are dominated by *Carex aquatalis* and *Eriophorum angustifolium* (narrow-leaf cottongrass). Mosses (usually *Scorpidium spp.* or *Drepanocladus spp.*) may be common (USGS, 1995). Grass communities on the Arctic plain are dominated by *Dupontia fischeri* and *Alopecurus alpinus* (mountain foxtail), however *Arctophila fulva* (pendent grass) dominates in surface waters of 15 to 200 cm in depth. Dwarf scrub communities include *Dryas integrifolia*, *Vaccinium vitis-idaea*, *Cassiope tetragona*,

Arctostaphylos alpina, *Arctostaphylos ruba*, *Salix reticulata*, and *Salix phlebophylla* (USGS, 1995). Secondary species include common names of lousewort, and buttercup in the wetter sites, and heather and purple mountain saxifrage in the raised drier habitats (AEIDC, 1975:122).

3. Northern Foothills

The distribution of vegetation in the northern foothills of the sale area is also affected by soil conditions, elevation, and drainage. Major streams flowing from the Brooks Range are controlled by bedrock. Plant communities in lakes form concentric bands that correspond with water depth. Lakes deeper than 1.5 m do not usually support aquatic plant life (USGS, 1995).

Plant communities are commonly dominated by mesic graminoid herbs and dwarf scrub. Mesic graminoid herbaceous communities are commonly dominated by tussock-forming sedges, and include *Eriophorum vaginatum* and *Carex bigelowii*. Low shrubs, such as *Betula nana* (Dwarf arctic birch), *Empetrum nigrum* (crowberry), *Ledum decumbens* (Labrador tea), and *Vaccinium vitis-idaea* (mountain cranberry) may also dominate plant communities along with sedges. Mosses and lichens are common between tussocks (USGS, 1995).

Dwarf scrub communities are dominated by *Dryas spp.*, ericaceous species, and (*Salix reticulata* and *Salix phlebophylla* (prostrate willows). Low scrub communities are dominated by *Alnus crispa* (alder), and *Salix lanata*, *Salix planifolia*, and *Salix glauca*. Mosses are commonly abundant (USGS, 1995). These plant communities provide an important source of nutrition for caribou as they forage on their summer range.

Waterbirds depend on or prefer certain habitat types, and attempts have been made to rank the value of these habitats, especially on the Colville River. Large ungulates (caribou, muskoxen) are equally dependent on vegetation habitats of the North Slope. Most of the oilfield areas are considered wetlands.

4. Wetlands

Wetlands are lands where saturation with water is the dominant factor in determining the nature of soils and the types of plant and animal communities living in the soil and on the surface. Wetlands occur where the water table is at or near the surface, the land supports at least periodically water-loving plants (hydro-phytes), and the substrate or surface is saturated with water or covered by water at some time during the growing season each year (Cowardin, et al., 1979:3).

Concern over wetland loss from gravel infilling associated with oil and gas development and its effects on calving, migration, nesting, and brood rearing, drives classification studies. Bergman et al. (1977) identified eight wetland designations related to birds (See Table 3.1)

Table 3.1 Wetland Designations

Class Designation	Cover type
Class I. Wetland Tundra	Wet sedge meadow, sedge, willow
Class II. Shallow-Carex	Wet sedge meadow, sedge, willow
Class III. Shallow-Arctophila	Wet grass-sedge meadow
Class IV. Deep-Arctophila	Wet grass-sedge meadow, Discrete lake
Class V. Deep-open	Discrete lake, Tapped lake
Class VI. Basin-complex	Wet sedge meadow
Class VII. Beaded streams	Barren
Class VIII. Coastal wetlands	Midgrass-herb, halophytic sedge, halophytic grass-sedge, halophytic herb

From Meehan & Jennings, 1988.

Meehan and Jennings (1988) studied the distribution and behavior of birds on the Colville Delta, and derived nine habitat classes for large waterbirds (Tundra swan, Greater white-fronted goose, Pacific loon, Yellow-billed loon, and brant):

- Discrete Lake habitat includes lakes and estuarine waterbodies, similar to Bergman's Class V.

- Tapped Lake habitat includes lakes that are hydrologically connected to a river system. In spring, flooded channels breach these lakes, allowing sediments and salt water to infiltrate. This class is also similar to Bergman's Class V.
- Wet-Moist Flooded Tundra includes wet sedge polygonal ground (Bergman's Class I) and moist sedge willow (Bergman's Class II).
- Wet Graminoid habitat is found along lake shores and polygonal ponds. Similar to Bergman Classes III and IV, the largest stands on the Colville Delta are located in its south central portion (located within the Sale 87 area). This habitat includes dominant species, *Arctophila fulva* and *Carex aquatalis*.
- Wet-Moist Polygons include moist to wet low tundra meadows; near lake ponds and margins, flooded basins, and polygonal ground. Similar to Bergman Classes I and II, this habitat is the most abundant vegetation cover on the Colville Delta. This vegetation type was used by Pacific and Yellow-billed loon nesting and Tundra swan and white fronted geese.
- Brackish Flats, similar to Bergman's Class VIII, are found along the fringe of the delta, river channels, and tapped lakes. This habitat type has been associated with high brant use.
- Shrub Dominant Areas consist of low willow communities on river banks, terraces and dunes. Most bird use was low, and there was no equivalent Bergman class.
- Barrens includes partially vegetated dunes, grass-forb lake shore, and partially vegetated and unvegetated floodplain. Similar to Bergman's Class VIII, this habitat is of low use by most birds and covers about 30 percent of the Colville Delta's total area.
- Sedge-Tussock Tundra, found in the western part of the delta, has no comparable Bergman class.

Meehan and Jennings (1988) ranked the importance of habitat classes relative to usage by key bird species. Discrete lakes were used the most, followed by Wet-Moist Polygons, Brackish Flats, Wet Graminoid, and Wet-Moist Flooded Tundra. Tapped Lakes and Shrub Dominant Areas received an equal amount of use after the top six, followed by Sedge-Tussock Tundra and Barrens which were used the least. The authors caution that although the classes may apply to habitats across the North Slope, the ranking should only be applied to the Colville River Delta.

In a remote sensing study of Snow goose brood-rearing habitat on the Sagavanirktok River delta, Burgess and Ritchie (1988) followed the classification scheme of Walker and Weber (1980) to derive a similar habitat classification (See Table 3.2)

Table 3.2 Snow goose brood-rearing habitat classification

Plant Community	Description	Dominant plant species
Moist Graminoid	moist upland sites, dry low-centered polygons and polygon rims	<i>Carex aquatalis</i> , <i>Dryas integrifolia</i> , <i>Salix arctica</i>
Wet Graminoid	wet areas in sand dune regions	<i>Carex aquatalis</i> , <i>Dupontia fischeri</i> , <i>Salix ovalifolia</i>
Wet Coastal Saline Graminoid	coastal estuaries and lagoon area normally flooded with salt water part of the year	<i>Carex subspathacea</i> , <i>Dupontia fischeri</i> , <i>Eriophorum angustifolium</i>
Very Wet Graminoid	pond and lake margins	<i>Carex aquatalis</i> , <i>Arctophila fulva</i>
Dry Coastal Bluff Barrens	coastal bluffs and ridges	<i>Dryas integrifolia</i> , <i>Sedum rosea</i>

From: Pollard, et al, 1992:4

More complex vegetation classification systems have been developed for oil and gas development proposals; some are species specific and some focus on terrain types. Field surveys are expensive, and increased complexity in project proposal documents provides agencies with more information to make permitting decisions. For example, in the Alpine Development Project, habitats on the Colville Delta are described with 24 habitat types; a system developed by Viereck, et al. 1992) and modeled after Cowardin, et al. (1979).

For the purposes of carrying out the provisions of Section 404 of the Clean Water Act, Cowardin, et al.(1979) developed a wetlands classification system for the USF&WS. Subsequently, a manual was developed for use by USACE field inspectors who make wetland determinations (USACE, 1987:7). Since

1979, numerous classification systems have been developed for wetland habitat characterization. Today, the USACE may use many classification systems in making wetland determinations. The more information and detail on site-specific characteristics, the better USACE is able to make wetland determinations (Carpenter, 1997).

Regardless of the habitat class system used in planning, the important points to consider are which plant species are associated with various life stages of important animals (feeding, nesting, incubation, brood rearing, etc.), and what is the most appropriate and practical way to identify those terrainis and important species. For caribou, some plant species may provide greater nutritional value for migrating, gestating, and new born animals. Since nearly all of the North Slope is wetland habitat, uplands are rare and may become more valuable to species like caribou, especially during the insect season. Non-wetland habitats include pingos, high-top polygons, steep river banks, gravel bars, and dunes (Carpenter, 1997). The following section discusses the sale area's fish and wildlife with references to key supporting habitats.

B. Fish and Wildlife Species, and Their Habitats

1. Fish

Fish species likely to be found in or near Sale 87 area waters are listed in Table 3.3. Important fishery resources are found within the sale area. Anadromous Dolly Varden spawn and overwinter in discrete and isolated sections of the Kavik, Canning, and Shaviovik rivers (Ott, 1996). A number of other streams in the sale area appear to contain suitable habitat for anadromous fish but have not been surveyed. A variety of freshwater fish species are present including Arctic Grayling, lake trout, northern pike, burbot, and several species of whitefish (Ott, 1995). Arctic char occur in the Sagavanirktok and Colville drainages but are not known to be anadromous in these systems. Dolly Varden also occur in both of these drainage, and include both anadromous and stream-resident forms (Ott, 1997).

The Colville River supports an abundance of fish, composed of at least twenty species, the dominant species being whitefishes and ciscos. Other species found in the Colville River include chinook, chum, and pink salmon, Dolly Varden char, and Arctic grayling. Like other North Slope rivers, the Colville River discharges warmer freshwater into the Beaufort Sea, forming a zone of warmer brackish water along the coast. This zone of brackish water is an important factor affecting the distribution and abundance of all Beaufort Sea fish because of its importance to anadromous fish for feeding and migrating. Freshwater fish species are found in lakes and the Colville River. These species include arctic grayling, round whitefish, non-migratory arctic char, burbot, ninespine stickleback, slimy sculpin, and lake trout (See Figure 3.1).

Nearshore waters and lagoon systems provide migration corridors and important feeding habitat for these anadromous fishes (USDOL, 1987). The warmer nearshore waters contain an abundance of amphipods, isopods, euphausiids, coelenterates, and chaetognaths (Gertler, 1988) which provide important food sources for anadromous fish in marine waters.

Anadromous fish typically leave the rivers and enter the nearshore waters of the Beaufort Sea during spring break-up, from mid-to late June. They initially occupy open water leads nearshore before dispersing along the coast to feed as the ice cover melts and recedes. Small fish tend to remain near overwintering rivers such as the Colville, while larger fish may migrate distances of 80 miles or more in search of feeding habitat. Migration back to rivers varies by species, but most anadromous fish return to freshwater, where they spawn, by mid-September (ADNR 1991a:13).

As with most anadromous fish species, whitefish spend much of their life cycle in salt water. They feed in salt water during the summer, but unlike other anadromous fish, generally remain in freshwater plumes extending out from river mouths and in marine waters of lower salinity. As with arctic char, these species move up river around mid-August and spawn in late September or October (Roguski and Komarek, 1971).

Table 3.3 Important Anadromous Fish Streams Located in Sale 87

Stream Name	Dolly Varden	Whitefish	Pink Salmon	Chum Salmon
Anaktuvuk River	X			
Canning River	X	X	X	X
Chandler River	X	X		
Colville River	X	X	X	X
Colville River Delta	X	X	X	X
East Badami Creek	X			
East Creek		X		
East Sagavanirktok Creek	X			
Echooka River	X			
Itkillik River	X	X	X	X
Ivishak River	X			X
Kadleroshilik River	X			
Kalubik Creek	X			
Kavik River	X			
Kuparuk River		X		
Little Putuligayuk River		X		
No Name River	X			
Putuligayuk River	X	X		
Sagavanirktok River	X	X	X	X
Sakonowyak River		X		
Shaviovik River	X			
Staines River	X	X	X	
Ugnuravik River		X		
Unnamed Lake, west of West Dock	X			
West Fork Kalubik Creek	X	X		

Source: Ott, 1997

Least cisco and arctic cisco are among the most abundant anadromous fish captured in the Prudhoe Bay and Sagavanirktok Delta areas. They inhabit the nearshore environment and spawn in the fall. The Colville River is a major overwintering area for cisco. During the ice-free period cisco undertake extensive migrations through the nearshore area (NSBCMP, 1984a:1-194). Cisco of the Colville River migrate from natal streams and tributaries of the Mackenzie River Delta system in Canada. Newly hatched Arctic cisco from Canada move westward into the Alaska Beaufort sea during late July to early August, especially in years with a prevalence of easterly winds. Thus, these fish must pass through the area of coastal development associated with Prudhoe Bay and Kuparuk oilfields. Arctic cisco of the Colville River delta spend most of the summer feeding in nearshore coastal waters, and then return to the river's channels and lakes in September and October to overwinter (Fechhelm and Griffiths, 1990).

Non-anadromous fish inhabit freshwater year-round. Virtually all Arctic grayling are found exclusively in freshwater throughout the year (Ott, 1997). Dolly varden, and broad and humpback whitefish remain in freshwater for several months or years, depending on the species, before migrating to coastal waters, returning to inland waters to spawn and overwinter (ADNR, 1990:25). A lack of overwintering habitat is the primary factor limiting arctic fish populations. Rivers freeze to the bottom over much of their length, therefore only the deeper sections are available for overwintering habitat (Sousa, 1992:2). The Colville River provides the most consistently available overwintering habitat (Baker 1987:1-8).

Figure 3.1 Important Anadromous Fish Habitat

2. Birds

Major concentrations of birds occur in and near portions of the Sale 87 area (See Figure 3.2 and Table 3.4). The Colville River, Fish Creek, Sagavanirktok River, Kuparuk River, and Canning River deltas, and Simpson Lagoon, are very important nesting and breeding areas for waterfowl (MMS, 1996a: III-B-6). Different species of birds are found among the several habitat types of the Sale 87 area.

The Colville, Sagavanirktok and Kuparuk river deltas provide important breeding and brood-rearing habitats for tundra swans, black brant, snow geese, and Canada geese. Howe Island, located in the Sagavanirktok River Delta, is the location of one of two known snow goose nesting colonies in the United States (Sousa, 1992). According to ADF&G, three colonies have been identified in Alaska: one in NPR-A in the Ikpikpuk River delta (50 nests), one in Kaseleguk Lagoon at the Kukpowruk River delta adjacent to the Chukchi Sea coast (50 nests), and one on Howe Island. In 1990, 380 to 450 snow goose nests were counted on Howe Island. In the past, the colony has been decimated by fox predation, however, the island is isolated by discharge from the Sagavanirktok River early in spring, generally preventing foxes from reaching the island in most years (Winters, 1997). This island also is important for black brant nesting (Sousa, 1992:3). The Return Islands, Jones Islands, McLure Islands, Cross Island, and Lion Point are important for nesting common eider. Thousands of oldsquaws concentrate near Flaxman Island to molt (Bright, 1992). Greater-white fronted geese are also found nesting and rearing in the major river deltas and other coastal plain areas (Ott, 1997:2).

The most abundant marine and coastal species include: red phalarope, oldsquaw, glaucous gull, and common eider. Nearly all of these species are migratory and are found in the Arctic seasonally, generally from May through September. Shortly after spring migration, most shorebird and waterfowl populations disperse to nesting grounds primarily on tundra and marshlands of the arctic slope. Beginning in late June, large concentrations of oldsquaw and eider occur in coastal waters inshore of islands where the birds feed and molt before fall migration. Use of lagoons and other coastal habitats peaks in August to late September before and during the fall migration (MMS 1996a:III-B-6).

Figure 3.2 Important Bird Habitat

Table 3.4 Birds Commonly Observed in the Vicinity of Sale 87 and their Commonly Used Habitats.

Common Name	Scientific Name	Barrier			Wetlands Tideflat	Rivers, Lakes, Streams	Uplands
		Offshore Areas	Islands/ Lagoons	Estuary			
Yellow-billed loon	<i>Gavia adamsii</i>	X	X	X	X	X	
Pacific loon	<i>Gavia arctica</i>	X	X	X	X	X	
Red-throated loon	<i>Gavia stellata</i>	X	X	X	X	X	
Tundra swan	<i>Olor columbianus</i>			X	X	X	X
White-fronted goose	<i>Anser alibifrons</i>			X	X	X	X
Snow goose	<i>Chen caerulescens</i>			X	X	X	X
Canada goose	<i>Branta canadensis</i>			X	X	X	X
Black brant	<i>Branta bernicla</i>		X	X	X	X	X
Mallard	<i>Anas platyrhynchos</i>				X	X	X
Pintail	<i>Anas acuta</i>				X	X	X
Green-winged teal	<i>Anas crecca</i> <i>carolinensis</i>				X	X	X
American wigeon	<i>Anas americana</i>				X	X	X
Northern shoveler	<i>Anas clypeata</i>				X	X	X
Greater scaup	<i>Aythya marila</i>				X	X	X
Lesser scaup	<i>Aythya affinis</i>				X	X	X
Common eider	<i>Somateria mollissima</i>	X	X	X	X	X	
King eider	<i>Somateria spectabilis</i>	X	X	X	X	X	
Steller's eider	<i>Polysticta stelleri</i>	X	X	X	X	X	
Spectacled eider	<i>Somateria fischeri</i>	X	X	X	X	X	
Oldsquaw	<i>Clangula hyemalis</i>	X	X	X	X	X	
Surf scoter	<i>Melanitta perspicillata</i>	X	X	X	X	X	
White-winged scoter	<i>Melanitta deglandi</i>	X	X	X	X	X	
Red-breasted merganser	<i>Merqus serrator</i>			X	X	X	
Rough-legged hawk	<i>Buteo lagopus</i>			X	X		
Harrier	<i>Circus cyaneus</i>				X		X
Golden eagle	<i>Aquila chrysaetos</i>				X		X
Gyrfalcon	<i>Falco rusticolus</i>				X		X
Peregrine falcon	<i>Falco peregrinus</i>				X		X
Willow ptarmigan	<i>Lagopus lagopus</i>						X
Rock ptarmigan	<i>Lagopus mutus</i>						X
Semipalmated plover	<i>Charadrius</i> <i>semipalmatus</i>		X		X	X	X
American golden plover	<i>Pluvialis dominica</i>		X		X	X	X
Killdeer	<i>Charadrius vociferus</i>		X		X	X	X
Black-bellied plover	<i>Pluvialis squatarola</i>		X		X	X	X
Bar-tailed godwit	<i>Limosa lapponica</i>				X	X	X
Buff-breasted sandpiper	<i>Tryngites subruficollis</i>		X		X	X	X
Long-billed dowitcher	<i>Limnodromus</i> <i>scolopaceus</i>				X	X	X
Ruddy turnstone	<i>Arenaria interpres</i>		X		X	X	X
Common snipe	<i>Capella gallinagp</i>		X		X	X	X
Whimbrel	<i>Numenius phaeopus</i>		X		X	X	X
Spotted sandpiper	<i>Actitis macularia</i>		X		X	X	X
Pectoral sandpiper	<i>Calidris melanotos</i>		X		X	X	X
Rufus-necked sandpiper	<i>Calidris ruficollis</i>	X		X	X	X	
White-rumped	<i>Calidris fuscicollis</i>		X		X	X	X

Chapter Three: Habitat, Fish and Wildlife

Common Name	Scientific Name	Offshore Areas	Barrier Islands/Lagoons	Estuary	Wetlands Tideflat	Rivers, Lakes, Streams	Uplands
sandpiper							
Dunlin	<i>Calidris alpina</i>		X		X	X	X
Baird's sandpiper	<i>Calidris bairdii</i>		X		X	X	X
Sanderling	<i>Calidris alba</i>		X		X	X	X
Semipalmated sandpiper	<i>Calidris pusilla</i>	X		X	X	X	
Red phalarope	<i>Phalaropus fulicaria</i>	X	X	X	X	X	X
Northern phalarope	<i>Phalaropus lobatus</i>	X	X	X	X	X	X
Parasitic jaeger	<i>Stercorarius parasiticus</i>	X	X		X		X
Pomarine jaeger	<i>Stercorarius pomarinus</i>	X	X		X		X
Long-tailed jaeger	<i>Stercorarius longicaudus</i>	X	X		X		X
Glaucous gull	<i>Larus hyperboreus</i>	X	X	X	X	X	X
Thayer's gull	<i>Larus thayeri</i>	X	X	X	X	X	X
Herring gull	<i>Larus argentatus</i>	X	X	X	X	X	X
Mew gull	<i>Larus canus</i>	X	X	X	X	X	X
Black-legged kittiwake	<i>Rissa tridactyla</i>	X					
Sabine's gull	<i>Xema sabini</i>	X	X	X	X	X	X
Arctic tern	<i>Sterna paradisaea</i>	X	X	X	X	X	X
Thick-billed murre	<i>Uria lomvia</i>	X					
Black guillemot	<i>Cephus grylle</i>	X	X				
Short-eared owl	<i>Asio flammeus</i>				X		X
Snowy owl	<i>Nyctea scandiaca</i>				X		X
Horned lark	<i>Eremophila alpestris</i>				X		X
Common raven	<i>Corvus corax</i>				X		X
Black-billed magpie	<i>Pica pica</i>				X		X
Robin	<i>Turdus migratorius</i>				X		X
Grey-cheeked thrush	<i>Catharus minmus</i>				X		X
Northern shrike	<i>Lanius exubitor</i>				X		X
Wheatear	<i>Oenanthe oenanthe</i>				X		X
Bluethroat	<i>Luscinia avacica</i>				X		X
Arctic warbler	<i>Phylloscopus borealis</i>				X		X
Yellow wagtail	<i>Motacilla flava</i>				X		X
Water pipit	<i>Anthus spinoletta</i>			X	X		
Wilson's warbler	<i>Wilsonia pusilla</i>				X		X
Hoary redpoll	<i>Carduelis hornemanni</i>				X		X
Common redpoll	<i>Carduelis flammea</i>					X	X
Savannah sparrow	<i>Passerculus sandwichensis</i>					X	X
Tree sparrow	<i>Spizella arborea</i>						X
White-crowned sparrow	<i>Zonotrichia leucophrys</i>					X	X
Fox sparrow	<i>Passerella iliaca</i>					X	X
Dark-eyed junco	<i>Junco hyemalis</i>					X	X
Lapland longspur	<i>Calcarius lapponicus</i>					X	X
Snow bunting	<i>Plectrophenax nivalis</i>					X	X

Source: Ott, 1992:4. ADNR, 1990:21.

Oldsquaw is probably the most common species of waterfowl that nests in the Beaufort Sea area. Male Oldsquaw begin moving in late June to protected coastal areas in lagoons and large lakes for molting (Ott, 1997). Their nests consist of small, cup-like hollows. Oldsquaw clutches of 9 to 12 eggs are common, but most number 5 to 10 eggs. In the Beaufort Sea area most eggs hatch from July 16 to July 28. Female Oldsquaws lead their young to the nearest water shortly after the young have hatched and dried. Male Oldsquaw begin moving in late June to protected coastal areas in lagoons and large lakes and form massive

molting flocks (Ott, 1997). Fall migration begins in late September or early October (Johnson and Herter, 1989:95).

The Red Phalarope is a common migrant and breeder throughout the Beaufort Sea. They appear in the Sale 87 area in late May or early June. Nesting takes place in hummocky, moss-seged tundra interspersed with numerous ponds. Females usually lay four eggs, however if breeding is delayed, clutch size is reduced. Males incubate the eggs and care for the young until shortly before they are fledged. The fledging period is 16 to 18 days. The male then abandons the young and departs the breeding area. Adult migration commences from early June to mid-August. The young depart the nesting areas from mid-August to early September (Johnson and Herter, 1989:184).

The Glaucous Gull is a common migrant and breeder in the Beaufort Sea area. They usually arrive in the Sale 87 area during May. Glaucous Gulls select several types of nesting sites depending on availability. Pairs either nest on low islands and sandbars near or on the coast or on inland river bars or small islands in lakes. They are most common on barrier islands immediately offshore from rivers that flood in the spring and thereby protect the nests from foxes. On level terrain, nests may be as much as a meter high and are composed of vegetation. Occasionally, nests consist of a simple depression in the beach and have little or no lining material. Egg laying begins in mid-June and continues through late June. The normal clutch size is 3 eggs and hatching begins in the second week of July. Chicks are attended by both parents until they fledge in about 45 to 50 days. During the breeding season these gulls prey heavily on the eggs and chicks of other birds. Fall migration begins in mid-September. The young remain somewhat later than most adults (Johnson and Herter, 1989:203).

The Common Eider is an abundant species in the Beaufort Sea area. It is sometimes called the Pacific Eider and arrives in the Sale 87 area from late May to early June. They most commonly nest on barrier islands and spits from mid to late June. Clutch sizes range from 1 to 10 eggs but usually number 4. Nests are usually placed in well protected areas near logs, in driftwood, between rocks or in thick vegetation. Young are usually led directly to water soon after they hatch. Fledging occurs from 6 to 12.5 weeks after hatching. Males then leave their nesting areas for molting areas in the vicinities of Point Lay, Icy Cape, and Cape Lisburne in western Alaska. Females and their young begin the fall migration in late August or early September (Johnson and Herter, 1989:73).

Tundra swans are common breeders on the coastal plain of the North Slope. The Colville River Delta supports densities of breeding Tundra Swans that are three to five times greater than other arctic areas of Alaska. Tundra Swans begin nesting during the last week of May and the first two weeks of June. Nests are large (approximately 1 m high and up to 2 m in diameter) and widely scattered. The nests are generally located on sedge tundra. After hatching in late June or early July, broods are reared in nesting territory (Smith et. al. 1993:12). Adults molt from mid-July through August. Fall migration occurs from late September to early October. They winter along the east and west coasts of North America, from the Aleutian Islands to California and from Maryland to North Carolina (Johnson and Herter, 1989:17).

Black brant are a common migrant and breeding bird along the Beaufort Sea coast. Black brant nest on islands in the Colville River and the Sagavanirktok River deltas. Nesting takes place in June. Black brant normally lay four to eight eggs. Black brant do not re-nest if their first attempt at nesting fails. The newly hatched geese leave the nest within 48 hours and they move to nearby tidal flats where they spend the brood-rearing period. Brood-rearing ends and the fall migration begins around the second week of August. Some brant remain in the Beaufort Sea area until late September or early October (Johnson and Herter, 1989:47).

Arctic peregrine falcons nest south of the sale area primarily on bluffs along the Colville River from Umiat to Ocean Point, and at Franklin and Sagwon Bluffs in the Sagavanirktok River drainage. Additional nest sites may occur at other locations. Arctic peregrine falcons are present on the North Slope from late April through September. Nesting begins by mid May, and the young birds fledge from late July to late August. Immature peregrine falcons from the Colville to the Sagavanirktok River drainages move toward the Beaufort Sea coast in mid-to late August. Peregrine falcons generally have left the North Slope by late September (Ott, 1997).

Snow geese arrive in the Sagavanirktok River delta during the last week of May and occupy nesting habitat on Howe Island in the first days of June. Most adult females arriving on the breeding grounds have already paired and copulated and have well-developed eggs in their oviducts. They lay their eggs within four

days to a week after they arrive. They build their nests of grass and bits of willow on high ground. Clutch size is three to six eggs which usually hatch during the last week of June or the first week of July. Snow goose goslings require about seven weeks to fledge. They leave the brood-rearing areas by approximately August 15 to August 20 and congregate in immense flocks on the coastal tundra to feed almost continuously. Snow geese and black brant from the Howe Island colonies often move to the Kadleroshilik River Delta to rear in the salt marshes (Ott, 1992). Half of the snow geese from the Howe Island colony take their broods to the Kadleroshilik River salt marshes for the months of July and August (Sousa, 1992:3). Fall migration begins in the second or third week of September (Johnson and Herter, 1989:29).

The historic breeding range of the spectacled eider includes the coastal tundra areas of the North Slope from Barrow to the U.S.- Canadian border (Sousa, 1992). The spectacled eider was listed as threatened under the Endangered Species Act in May 1993. Probably less is known of the spectacled eider than of any other North American migratory waterfowl species. Spectacled eiders occur throughout the lease sale area. All of the onshore tracts are within the expected breeding range for this species (Sousa, 1997).

Important habitats for arctic-breeding Spectacled Eiders include large river deltas, tundra rich in lakes, and wet, polygonized coastal plains with numerous waterbodies (USDOI, 1996:24). Females lay one egg per day and begin incubation with the laying of the last egg. Clutch size averages between 3.8 and 4.5 eggs. Hatching occurs from mid-to late July. Fledging occurs approximately 50 days after hatching. Females and their broods then move directly from freshwater to marine habitats (USDOI, 1996:20). During August, productive adults undertake their summer molt. Fall migration from the Beaufort Sea by males may begin in mid-summer. Most Spectacled Eiders have left the coast by September 20 (Johnson and Herter, 1989:87).

The Steller's Eider is an uncommon breeder along the Beaufort Sea Coast. Little is known about the breeding biology of the Steller's Eider but they are thought to nest near the coast only where deep water is present offshore. In the Barrow region, they nest on tundra along the shores of lakes, ponds and lagoons. The nest is a deep cup in the tundra. It consists of curly, coarse grasses and various mosses and lichens and is well lined with down and feathers. Females lay between six to ten eggs and incubate them for about three weeks. Hatching along the Beaufort Sea apparently begins during the first or second week of July. Most young are probably ready to fly by August. Steller's Eiders migrate from the Beaufort Sea during late September and early October (Johnson and Herter, 1989:91). They were listed as threatened under the Endangered Species Act on June 11, 1997.

Canada Geese arrive along the arctic coast during the last two weeks of May and the first week of June. They nest primarily away from the sea coast, on bluffs along the Colville River. However, some isolated pairs have been found nesting in moderate densities in coastal wetlands near Prudhoe Bay. They usually lay their eggs during the first or second week of June. The clutch size may vary from 1 to 10 eggs which hatch within the first two weeks of July. After the goslings have fledged in mid-August, flocks begin dispersing along the Beaufort Sea and begin their southward migration.

The Greater white-fronted goose is a common breeding bird along the Beaufort Sea coast. They reach the Beaufort Sea breeding areas from the second week of May to the first week of June. The female usually selects a nest site on well-vegetated (scrub willow tundra) and well-elevated habitat near a lake or river. Eggs are laid during the last half of May or the first two weeks of June. The female lays her eggs in a slight depression and builds the nest as she completes her clutch of 4 to 7 eggs. The incubation period varies from 23 to 28 days. Breeding adults usually molt when goslings are two to three weeks old. Fall migration may begin as early as August 10 with the last Greater White-fronted Geese leaving Alaska by the end of September (Johnson and Herter, 1989:23).

The Colville River Delta supports some of the highest densities of breeding Yellow-billed loons in Alaska (Smith et al 1993:i). Yellow-billed loons arrive in the Sale 87 area in late May. They concentrate during spring with other species of loons in early-melting areas off the deltas of the Sagavanirktok, Kuparuk, and Colville Rivers. Yellow-billed loons prefer gently sloping shores of deep tundra lakes as nest sites. The nest is usually a built-up mound of turf and mud on the shoreline of a lake or occasionally on the shoreline of a large river. Egg laying begins as early as the second week of June and hatching takes place in July and early August. The normal clutch size is two eggs. The age at which Yellow-billed loons fledge has not been recorded precisely but may be similar to Common Loon chicks which is 45 days. The peak fall migration for Yellow-billed loons is in late August or early September (Sousa, 1995:2; Johnson and Herter, 1989:9).

3. Terrestrial Mammals

a. Caribou

Caribou (*Rangifer tarandus*) are members of the deer family. Four caribou herds use the coastal habitats within and adjacent to the Sale 87 area. A herd is a group of caribou which establishes a calving area distinct from any other group and calves there repeatedly (ADF&G, 1994). The Western Arctic Herd (WAH) ranges over an area that extends approximately from the Colville River to the western coast of Alaska (See Figure 3.3). The Porcupine Caribou Herd (PCH) ranges adjacent to the sale area, south from the Beaufort Sea coast, from the Canning River eastward into Canada. The range of the Central Arctic Herd (CAH) extends from the northern foothills of the Brooks Range to the Beaufort Sea and from the Colville River east to the Canning River. A fourth herd, the Teshekpuk Lake Herd (TLH) occupies the area around Teshekpuk Lake, west of the Sale 87 area. TLH caribou have been observed in the Colville River Delta seeking relief from insect harassment (Smith et al, 1993:46.) See Figure 3.3 showing caribou distribution.

Caribou normally move toward the coast to calve and escape the predators of their winter range. The WAH's major calving area is inland on the NPRA. The PCH calving range is along the Beaufort Sea coast from the Canning River to the Babbage River in Canada. The location of calving areas has changed over time. The CAH calving area has been described as the area between the Eastern Channel of the Colville River and Kalubuk Creek (Smith et al., 1994, 9; citing to Lawhead and Cameron, 1988). Current primary calving concentration areas lie between the Sagavanirktok and Canning Rivers in the area south of Bullen Point, and to the southwest of the Kuparuk oilfield (Ott, 1997). Lesser used calving areas have also been identified in the area between the Eastern Channel and the Nechelik Channel of the Colville (Smith, et al. 1994, 9; citing to Whitten and Cameron, 1985) and in the foothills of the Brooks Range, south of the Colville River delta. Use of calving habitat varies with weather and snow conditions. The fidelity of caribou to their calving area suggests that certain areas, such as those mentioned above, may be more important than other seasonal ranges.

In late May or early June a single calf is born (twins are very rare) mostly within 30 miles of the coast. Coastal areas seem to be preferred calving habitats, but calving occurs further inland as well (Baker 1987:1-3). Newborn calves can walk within an hour of birth. After a few days, they can outrun a man and swim across lakes and rivers. Newborn calves weigh an average of 13 pounds and may double their weight in 10-15 days (ADF&G, 1994).

Caribou summer on the arctic coastal plain. The CAH spends June through mid-August near the Arctic coast between the Colville and Canning Rivers (Whitten, 1995). In midsummer, from mid-to late June through July, caribou are often harassed by hordes of mosquitoes, warble flies, and nose flies. Movement during the summer is closely tied to insect harassment. In response, caribou move from inland feeding areas to windswept, vegetation-free coastal areas where the insects are limited. Sometimes the animals will run in a frenzy for long distances, stopping to rest only when exhausted or when wind offers relief from the insects (ADF&G, 1994). Most insect relief areas are found within two miles of the coast (ADF&G 1986b:71), however, caribou also tend to congregate on gravel drilling pads and roads which are generally raised above the tundra and more exposed to the elements (USACE 1984:141). Caribou that remain inland may move to river bars and bluffs to escape these insects. The frequency and duration of caribou movements to and from the coast depend on weather related changes that affect the number of mosquitoes. Caribou distribution on the coastal plain can change dramatically within a 24-hour period.

The fall migration south begins in September and ends by mid-November. During both the spring and fall migrations, the herd tends to move along or near major river drainages, such as the Itkillik, Kuparuk, Shaviovik, and Canning. Caribou generally winter in the northern foothills of the Brooks Range. Occasionally, some remain on the coastal plain during mild winters. (Ott, 1992).

Figure 3.3 Important Wildlife Habitat

Caribou must keep moving to find adequate food. This distributes feeding pressure and tends to prevent overgrazing. Caribou are great wanderers and very efficient at moving across both boggy and rugged terrain. They commonly travel vast distances to reach suitable foraging sites on widely separated season ranges. Feeding opportunities are limited in windswept insect relief areas, so caribou move inland to better foraging areas whenever insect harassment temporarily subsides, and return to the coast when harassment increases. In summer, caribou eat a wide variety of plants, apparently favoring the leaves of willows, grasses, and herbaceous and flowering plants. During winter, they use windswept upland areas, or areas of lighter snow cover where they can dig through the snow to feed on lichens, "reindeer moss," and dried sedges (ADF&G, 1994).

Historic population counts for all four herd populations are depicted in Table 3.5. Caribou calf survival and adult mortality are primary factors affecting the size and growth of caribou herds. The WAH population grew to about 450,000 by 1993, primarily because calf survival far exceeded adult mortality until the early 1990s. However, biologists note that the WAH calf survival rate is in decline, and adult deaths per 100 animals are increasing; a trend which may result in herd size reduction if it persists. Neither hunting pressure, disease, nor predation by wolves or bears appear to be a factor in the calf survival or adult mortality trend (Cronin, et al., 1994)(ADF&G, Undated).

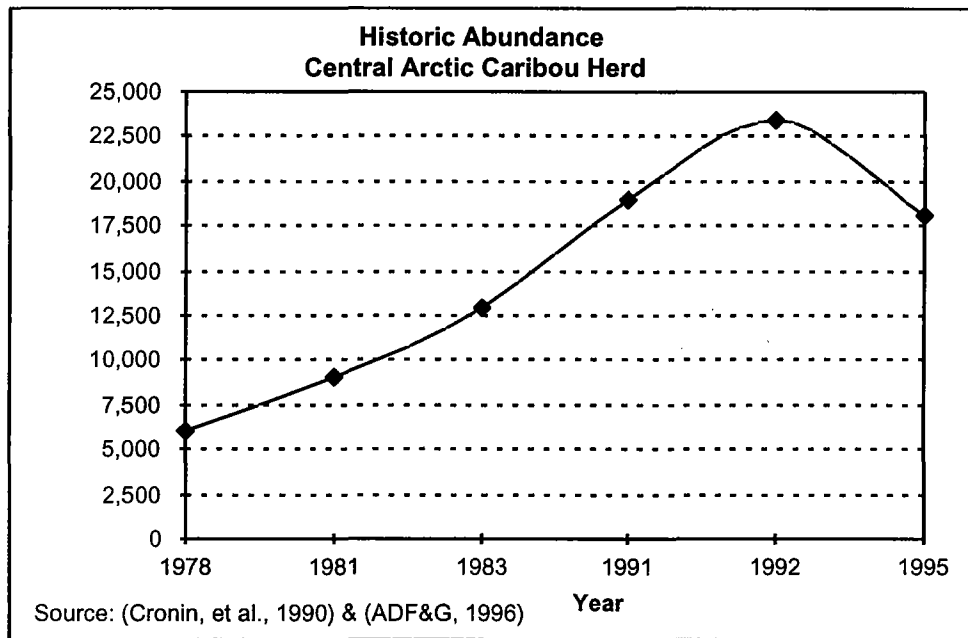
Table 3.5 Historic Population Counts for Caribou Herds.

Western Arctic Herd		Central Arctic Herd		Teshekpuk Caribou Herd		Porcupine Caribou Herd	
Year	No. of Animals	Year	No. of Animals	Year	No. of Animals	Year	No. of Animals
1976	75,000	1978	6,000	1982	4,000	1972	100,000
1978	102,000	1981	9,000	1989	16,700	1977	105,000
1980	138,000	1983	12,900	1993	27,600	1982	125,200
1982	171,700	1991	18,900	1995	26,000	1983	135,300
1986	229,400	1992	23,400			1987	165,000
1988	343,200	1995	18,093			1989	178,000
1991	415,700					1992	163,500
1993	450,000					1994	152,000

Source: Cronin, et al., 1994; ADF&G, Undated; Whitten, 1995; Ott, 1997.

ADF&G's 1995 photo-census revealed fewer caribou in the CAH than in previous census years. The current decline is likely due to a reduction in calf production; a factor biologists correlate with lower nutritional condition of cows at the end of the summer grazing season. While this lack of nutrition may be linked to summer forage availability, other factors may explain the decline in herd size. "After its rapid increase through the 1980s, the CAH may have reached carrying capacity. This could have resulted in population stability. Or, if the population temporarily exceeded carrying capacity, there could have been overgrazing leading to a population decline" (Whitten, 1995:2).

Indications that a herd may overgraze its range and "crash" include smaller calf weight and lower calf production. Awareness of those factors recently prompted ADF&G to thin out the Nelchina caribou herd by increasing the sport hunting harvest, as its current population is approaching what biologists think is its carrying capacity. That herd experienced a dramatic decline in population (70,000 animals to less than 10,000) from 1960 to the early 1970's (ADN, 1996).



b. Moose

Moose are the world's largest members of the deer family and the Alaska moose (*Alces alces gigas*) is the largest of all the moose. Moose breed annually and both sexes may begin breeding at an age of 16 to 18 months. Calves are born any time from mid-May to early June after a gestation period of about 230 days. Calves begin taking solid food a few days after birth. Newborn calves weigh 28 to 35 pounds and within five months grow to over 300 pounds (ADF&G, 1994).

Rutting occurs during the fall between late September and early October. During this period, moose may aggregate in groups of up to 30 bulls and cows, with movement of individuals between the groups (ADF&G 1986a:139-146).

Moose eat a variety of foods, particularly sedges, equisetum (horsetail), pond weeds, and grasses. During summer, moose feed on vegetation in shallow ponds, forbs, and the leaves of birch, willow, and aspen. Willow stands along rivers and streams are important winter habitat for moose. These riparian areas are especially important during winter when forage is mainly confined along major drainages where shrubs will not be covered by drifting snow. (Sousa, 1992).

Following the snow melt, usually around the beginning of May, moose occasionally disperse across the tundra, but are mainly found in varying elevations in the foothills (See Figure 3.3). Calving also occurs at this time. Moose feed on aquatic vegetation, grasses, sedges, and willow during spring and summer. During winter they feed on deciduous shrubs and crater in the snow for ferns, willow, and foliose lichen.

Moose have a high reproductive potential and can quickly fill a range to capacity if not limited by predation, hunting, and severe weather. Deep crusted snow can lead to malnutrition and subsequent death of hundreds of moose and decrease the survival of the succeeding year's calves. Predation by wolves and bear limits the growth of moose populations in Alaska (ADF&G, 1994).

Moose are found concentrated in winter along portions of the Canning, Kavik, Echooka, Sagavanirktok, and Colville rivers; and Juniper Creek in the southern portion of the sale area ADF&G, 1986 atlas). General distribution occurs all across the North Slope, but this has not always been the case. Fifty years ago there were few moose on the lower Colville River. Breeding populations migrated north and became established. Surveys in the last 26 years show a population increase from 1200 to 1600 moose in that time. Today, the North Slope moose population is experiencing an alarming decline. The adult population has

declined by 50 percent in the last four to five years. There has been little if any calving success in the last three years, and biologists are not sure of the cause. It could be a combination of factors, such as food availability and habitat limitation (population beyond carrying capacity of the habitat), disease, nutrition, predation, toxicity, and mosquito harassment. Food supply varies from year to year, and forage is limited. Moose populations along the Colville and Kavik Rivers are at the northern extent of the species' range, and they are susceptible to bad winters. Increasing populations of wolf and bear are also a likely factor contributing to the decline (Carroll, 1996). A lack of forage could lead to a mineral deficiency which can result in increased predation. Toxicology analysis on the tissue of dead animals collected in the summer of 1996 are being analyzed (O'Hara, 1996).

c. Brown Bears

Formerly, taxonomists listed brown and grizzly bears as separate species. Technically, brown and grizzly bears are classified as the same species, *Ursus arctos*. Generally the term brown bear is used for those found in coastal areas while bears found in the interior areas of Alaska are known as grizzlies (ADF&G, 1994).

Brown bears travel along the major river corridors and feed extensively in riparian areas of the Sale 87 area in the spring and summer and often make their dens along river banks in the fall (See Figure 3.3). Recent investigations of radio-collared bears in the Prudhoe Bay area revealed an unnaturally high and productive population of brown bears in the oil field, most likely due to the supplemental food supply (garbage) available there (Sousa, 1992:6). Bear weights vary depending on the time of year. Bears weigh the least in the spring or early summer. They gain weight rapidly during late summer and fall just prior to denning (ADF&G, 1994).

In the winter when food is unavailable or scarce, brown bears enter dens and hibernate through the winter. During hibernation, their body temperatures, heart rate, and other metabolic rates are reduced, and their need for food and water is eliminated. Bears may spend from 5 to 7-1/2 months in dens. Brown bears enter their dens from mid October through November (Ott, 1997). On the coastal plain, bears den in low hills, dry lake margins, and stream banks to at least within 20 miles of the coast (Ott, 1991). Recent ADF&G grizzly bear research confirms that some of the bears using the oilfields den within a mile of the coast (Ott, 1997). They normally leave their dens in April and early May; adult males emerge first, followed by single females, then sows with young (ADF&G, 1994).

Except for females with offspring and breeding animals, bears are typically solitary creatures and avoid the company of other bears. Exceptions to this occur where food sources are concentrated, such as streams, where bears can catch salmon swimming upstream to spawn (ADF&G, 1994). In the spring, brown bears are commonly found in major river valleys, such as the Colville and Itkillik. They later move to small tributaries and poorly drained areas to feed.

Mating takes place from May through July with the peak of activity in early June. Brown bears generally do not have strong mating ties. Individual bears are rarely seen with a mate for more than a week. Males may mate with more than one female during breeding season. The young are born the following January or February in a winter den. Litter size ranges from one to four cubs, but two is most common. Offspring typically separate from their mothers as two-year olds in May or June. In some areas where food is scarce, females may skip one to three years before producing new litters. Bear populations vary depending on the productivity of the environment. In areas of low productivity, such as on Alaska's North Slope, studies have revealed bear densities as low as one bear per 300 square miles (ADF&G, 1994).

Brown bears consume a wide variety of foods such as berries, grasses, sedges, horsetails, cow parsnips, fish, ground squirrels, and roots of many kinds of plants. In some parts of Alaska, brown bears have been known to prey on newborn moose and caribou. They can also kill healthy adults of these species. Bears are fond of all types of carrion as well as garbage in human dumps. Brown bears have an especially good sense of smell and under the right conditions may be able to detect odors more than a mile distant (ADF&G, 1994). During the summer bears most frequently feed in wet sedge meadows, late snow bank areas, and tussock tundra, concentrating on grasses, sedges, the fruiting and vegetative stems of horsetails. In the fall, bears tend to use the floodplains of large creeks and rivers, dry ridge areas or mountain slopes and feed on roots, berries, and ground squirrels (ADF&G 1986a:103-109).

d. Muskoxen

The muskox (*Ovibos moschatus*) is a stocky, long-haired animal with cloven hooves, a slight shoulder hump and a very short tail. Taxonomists classify muskoxen with the sheep and goats. Muskoxen as a species have changed little since the ice age and are perfectly adapted to live in their harsh arctic environment (ADF&G, 1994).

The original Alaska muskoxen disappeared in the mid- or late 1800s as a result of over-hunting. Muskoxen were re-introduced in the Arctic National Wildlife Refuge (ANWR) in 1969, and are continuing to expand westward into the Sale 87 area west of the Canning River (USDOI 1987:26).

In early April 1992, more than 75 individuals were seen in the Sagavanirktok River drainage north of Sagwon, and 218 were seen within the boundaries of the Sale 87 area (Sousa, 1992:4). Riparian habitat is preferred by muskoxen for virtually their entire annual cycle. River systems that provide diverse low shrub-forb and tall willow communities in proximity to relatively snow-free uplands, hillsides, and plateaus are important to muskoxen (Sousa, 1992). Small numbers of muskoxen occur in the Colville River Delta, in the area of the lower Itkillik River valley, and the headwaters of the Miluveach and Kachemach rivers (Ott, 1997). Known wintering areas occur along riverside bluffs in the southwest corner of the Sale 87 area, in the vicinity of the Sagavanirktok and Ivishak rivers, and along the Kavik and Shaviovik River drainages near the coast. During summer they also utilize the Kadleroshilik drainage (Sousa, 1992).

Muskoxen are relatively sedentary in the winter (October-May), possibly as a strategy for conserving energy. Muskoxen are not migratory, but they may move in response to seasonal changes in snow cover and vegetation. Many bull muskoxen move from mixed sex groups during the summer to bull groups during the winter. Females calve from late April to mid-June, and newborn calves have been observed in ANWR during mid-June. Limited data suggests that the majority of the population calves in the southern portion of the Arctic Coastal Plain on wind-blown, snow-free banks within riparian areas, and in upland sites in the foothills. The rutting season generally occurs in August (Sousa, 1992).

Muskoxen eat a wide variety of plants, including grasses, sedges, forbs, and woody plants. In summer and fall, both sexes may be found along major river drainages where they feed on willows and forbs. In winter and spring, muskoxen groups of 10 to 20 animals may be found in the uplands adjacent to river drainages which afford forage of tussock sedges and have less snow cover (USDOI, 1987:27). Muskoxen are poorly adapted for digging through heavy snow for food, so winter habitat is generally restricted to areas with shallow snow accumulations or areas blown free of snow (ADF&G, 1994).

e. Furbearers

Other species that may be found in the Sale 87 area include arctic and red fox, wolf, and wolverine. Information on the abundance and distribution of these species is limited.

Arctic fox. The arctic fox (*Alopex lagopus*) is found within the proposed Sale 87 area. Both blue and white color phases occur, with the white color phase more common in northern litters. Young of each color phase may occur in the same litter (ADF&G, 1994).

Fully grown arctic foxes weigh from 6 to 10 pounds. They average 43 inches in length including the tail, which averages 15 inches in length. Arctic foxes may move long distances over sea ice. A fox tagged along the coast of Russia was captured near Wainwright, Alaska a year later (ADF&G, 1994).

Arctic fox pups are born in dens excavated by the adults in sandy, well-drained soils of low mounds and river cut backs. Most dens have southerly exposure. They extend from 6 to 12 feet underground. Enlarged ground squirrel burrows with several entrances are often used as dens (ADF&G, 1994).

Mating occurs in early March and early April. Gestation lasts 52 days. Litters average seven pups but may contain as many as 15 pups. Arctic foxes are monogamous in the wild. Both parents aid in bringing food to the den and in rearing the pups. Pups begin eating meat when about one month old and are fully weaned by 1-1/2 months. They emerge from the den when about three weeks old and begin to hunt and range away from the den at about three months. Arctic foxes attain sexual maturity at nine to ten months, but many die in their first year (ADF&G, 1994).

Arctic foxes are omnivorous. In summer, they feed primarily on small mammals, including lemmings and tundra voles. They sometimes eat berries, eggs, and scavenged remains of other animals. Many foxes venture out onto the sea ice during winter to eat the remains of seals killed by polar bears. In areas where lemmings and voles are the most important summer prey, numbers of foxes often rise and fall with cyclic changes of their prey. Fewer pups are successfully reared to maturity when food is scarce. There is evidence indicating that competition for food among young pups accounts for some of the heavy mortality in this age group (ADF&G, 1994).

Wolf. Wolves (*Canis lupus*) are adaptable and exist in a wide variety of habitats including the arctic tundra along the Beaufort Sea. Wolves are members of the family Canidae. They are highly social animals and usually live in packs averaging 6 to 7 animals (ADF&G, 1994).

Wolves normally breed in February and March, and litters averaging about five pups are born in May or early June. Litters may include from 2 to 10 pups, but most often 4 to 7 pups are born. Most female wolves first breed when 22 months old but usually have fewer pups than older females. Pups are usually born in a den excavated as much as ten feet into well-drained soil, and most adult wolves center their activities around dens while traveling as far as 20 miles away in search of food, which is regularly brought back to the den. Wolf pups are weaned gradually during midsummer. In mid- or late summer, pups are usually moved some distance away from the den and by early winter are capable of traveling and hunting with adult pack members. Wolves are great travelers, and packs often travel 10 to 30 or more miles in a day during winter. Dispersing wolves have been known to move from 100 to 700 miles from their original range (ADF&G, 1994).

In spite of a generally high birth rate, wolves rarely become abundant because mortality is high. In much of Alaska, hunting and trapping are the major sources of mortality, although diseases, malnutrition, accidents, and particularly preying by other wolves act to regulate wolf numbers (ADF&G, 1994).

Wolves are carnivores, with moose and/or caribou as their primary food. During summer, small mammals including voles, lemmings, ground squirrels, snowshoe hares, beaver, and occasionally birds and fish are supplements in the diet. Wolves are opportunistic feeders; very young, old, or diseased animals are preyed upon more heavily than other age classes. Under some circumstances, however, such as when snow is unusually deep, even animals in their prime may be vulnerable to wolves (ADF&G, 1994).

Wolverines. The wolverine, is the largest terrestrial member of the family *Mustelidae*. Its scientific name is *Gulo gulo*, meaning glutton. Wolverines are primarily found in the wilder and more remote areas of Alaska (ADF&G, 1994). They frequent all types of terrain and often utilize rivers as territorial boundaries (USDOI, 1987:339).

Wolverines become sexually mature in their second year. Breeding takes place between May and August. After wolverines mate, the embryo floats in the uterus until late fall or early winter. This type of reproduction is known as delayed implantation, and allows a female wolverine to become pregnant when food supplies are plentiful and when she is in good physical condition. The abundance of food determines whether a pregnancy will be maintained and the number of young that will be born (ADF&G, 1994).

Litters are born between January and April. In Interior and northern Alaska, most young are born in snow caves. These caves usually consist of one or two tunnels that can be up to 60 yards long. Litters usually number between one to three. Baby wolverines, called kits develop rapidly and are weaned at about 8 weeks of age. They leave their mothers at approximately 5 or 6 months to forage for themselves (ADF&G, 1994).

Wolverines travel extensively in search of food. They are opportunistic, eating about anything they can find or kill. They are poor hunters but are well adapted for scavenging. Wolverines can survive for long periods on little food. Their diet varies from season to season depending on food availability. In the winter, wolverines rely primarily on remains of moose and caribou killed by wolves and hunters or animals that have died of natural causes. Throughout the year, wolverines feed on small and medium-sized animals such as voles, squirrels, snowshoe hares, and birds. In the right situations, wolverines can kill moose or caribou, but these occurrences are rare (ADF&G, 1994).

4. Marine Mammals

a. Polar Bears

Polar bears (*Ursus maritimus*) occur only in the northern hemisphere, nearly always in association with sea ice (See Figure 3.4). They are marine mammals and are protected under the Marine Mammal Protection Act. Polar bears and brown bears evolved from a common ancestor and are still closely related, as demonstrated by matings and production of fertile offspring in zoos. Although polar bears may be similar in size to some southern coastal brown bears, they are considerably larger than the brown bears found along the North Slope (Ott, 1997). Adaptations by the polar bear to life on sea ice include a white coat with water repellent guard hairs and dense underfur, short furred snout, short ears, teeth specialized for a carnivorous diet, and hair nearly completely covering the bottom of the feet (ADF&G, 1994).

Polar bears range throughout the coastal areas of the proposed Sale 87. Their dens have been found as far as 32 miles inland (USF&WS, 1987:30). Their distribution is strongly influenced by the local and annual patterns of ice formation, distribution, and thaw. The reforming of the landfast ice sheet in late fall and early winter triggers the return toward land of male polar bears from the permanent pack ice far offshore (MMS, 1993:5). Seasonal movements are influenced primarily by the state of the sea ice and its effect on the distribution of prey. The distribution of their primary food source, seals, is influenced by ice conditions and water depth (Stirling, 1990). Between 1967 and 1992, the population grew about 2 percent per year and may have reached carrying capacity (Amstrup, 1995). The Alaskan population is estimated between 3,000 and 5,000 bears (USDOI, 1995) with at least 140 females seeking dens each fall. Based on radio collar surveys, the Beaufort Sea population dens locally, and is not dependent on reproduction from other known denning areas outside of the region (Amstrup & Gardner, 1994).

Polar bears breed from late March to May (USDOI, 1995) and males travel long distances during this time, searching for females. When a male finds a female, he stays with her a few days, breeds and then goes off in search of another. During early November and December, the pregnant females search out deep snow drifts in which to dig their dens (ADF&G, 1994).

Denning occurs on both land and on sea ice with about half occurring on each. Bears that den on the ice may drift up to 600 miles during the winter. Biologists had earlier thought that pregnant females returned to the same den and thus the specific location of known dens was important for pre-application development planning. However, research indicates that bears do not den in the same place, but are only faithful to the general substrate and geographic area upon which they had previously denned: on ice or on land, and in the eastern or the western Beaufort respectively. The most preferred region for land denning is located east of the proposed Sale 87 area in the northeast corner of Alaska and adjacent to Canada (Amstrup, 1995:291-293)(USDOI, 1995). On the Beaufort coast, polar bears excavate their dens in deep compacted snow drifts adjacent to bluffs, barrier islands, and other elevated areas (Amstrup and DeMaster, 1988). Radio tracking and visual observations have confirmed den locations at Milne Point, Beechy Point, and adjacent to bluffs of the Sagavanirktok River delta (USDOI, 1995:25). The Jones Island group, other barrier islands, and certain coastal areas are important for maternity denning polar bears (Bright, 1992). "Flaxman, Pingok, Cross, Cottle, Thetis and other barrier islands in the Beaufort Sea are known to support maternity dens." (USDOI, 1995:27). For reasons that continue to elude biologists, the highest density of land denning in Alaska occurs outside of the proposed Sale 87 area along the Beaufort coast of the Arctic National Wildlife Refuge (USDOI, 1995).

A denning female excavates a depression in the snow under a bank, on a slope, or near rough ice. She enlarges the denning chamber as drifting snow accumulates in depth. Pregnant females choose denning areas that have enough topographic relief and the proper slope aspect (south-facing) to catch and hold snow banks under a variety of autumn conditions. In the Beaufort Sea, these conditions appear to be most common on the mainland near the coastline and along rivers where sharp banks accumulate snow. Most dens found on land in Alaska have been less than 6 miles from the coastline, although some occurred up to 36 miles inland (MMS, 1993:8-9).

Figure 3.4 Important Marine Mammal Habitat

Cubs are born during December and January. Normally the female has two cubs. The average female may produce only 1 or 2 litters during her life. Thus, few cubs are produced to replace bears that die. Temperatures in the den are usually much higher than outside, and the cubs could not survive without the shelter of the den and their mother's care. They make short trips to and from the open den for several days as the cubs become acclimated to outside temperatures. They then start traveling on the drifting sea ice (ADF&G, 1994). The mother does not eat while denning; both she and her cubs live off her fat reserves. They stay in their dens all winter, but they can be aroused from their dens by disturbance (MMS, 1993:8-9). Female bears and cubs emerge from dens in late March or April, and may remain near their dens for up to 15 days. Bears and cubs move onto the sea ice during summer. Cubs stay with their mother for about 28 months. Upon separation she usually breeds again. Litters are produced generally every 3 to 4 years (ADF&G 1986a:78).

The main food of polar bears in Alaska is the ice-inhabiting ringed seal. Bears capture seals by waiting for them at breathing holes and at the edge of leads or cracks in the ice. They also stalk seals resting on top of the ice and catch young seals by breaking into pupping chambers on top of the ice in the spring (ADF&G, 1994). Hunting polar bears concentrate near open leads in winter. An important habitat zone in the eastern Beaufort Sea is the seaward edge of the landfast ice, corresponding roughly with the 66 foot isobath (Stirling, 1990). Bears have difficulty catching seals in open water. A polar bear has to catch approximately one seal a week to maintain itself. Bears can eat up to 10 percent of their body weight in 30 minutes. The stomach of a large bear may hold up to 200 pounds of food. Other sources of food include walrus, small whales, birds, seaweed, eggs, berries, lemmings, shrubs, lichens, and grass and occasionally other polar bears. Occasionally polar bears prey on humans (MMS, 1993:5).

Polar bears derive a significant part of their fall and winter diet from whale and walrus carcasses (USDOJ, 1995). They also scavenge many things including human garbage, and food caches. They chew on and may eat a variety of manufactured items, including rubber, plastic, rope, canvas, motor oil, snow machine seats, chemicals, and batteries. (MMS, 1993:5).

b. Pinnipeds

The pinniped family, includes ringed seals, spotted seals and walrus. These species are not present in the proposed sale area but are nearby, along the Beaufort Sea coast. Pinna, means a wing or fin; and pedts, a foot. Pinnipeds are protected under the Marine Mammal Protection Act of 1972. Ringed seals are the smallest of the pinnipeds and are the most abundant seal in the Beaufort Sea (ADF&G, 1994).

Ringed seals. Activities of ringed seals (*Phoca hispida*) on the ice vary with the seasons of the year. During the late spring and early summer, ringed seals use the ice as a solid surface on which to haul out and complete their annual molt. They are usually found near cracks, open leads or holes where they have rapid access to water. During winter and spring, most of the breeding adults are found on stable land-fast ice. From March through May, during the spring breeding and pupping season, high densities of adults remain on the land-fast ice while subadults are most numerous in adjacent flow ice zones (LaBelle et al., 1983) (See Figure 3.4).

Females give birth to a single, white-coated pup in snow dens on either landfast or drifting pack ice during March and April. Female seals build lairs in pressure ridges or under snowdrifts for protection from predators and severe weather. There is some evidence that females lacking maternal experience give birth in drifting pack ice and may be more subject to polar bear predation. More experienced females give birth in landfast ice and may have higher reproductive success (ADF&G, 1994).

Ringed seals molt in May and June. During this time they spend long periods hauled out on the ice basking in the sun. It is thought that warmer skin temperatures cause the new hair to grow more quickly. When hauled out on the ice, ringed seals are very wary, raising their heads every 20 seconds or so to look around. They rapidly enter the water when they detect an approaching human or other predator. (ADF&G, 1994)

The amount of time spent on the ice increases as the molt season progresses. In summer, as the nearshore ice melts, most of the adult ringed seals are found along the edge of the pack ice, seaward of the proposed Sale 87 area. Subadults may remain in the ice free areas. Open leads and cracks in the ice are used by ringed seals to surface and breathe. During the fall as freeze-up begins, seals will actively keep breathing holes open (Stirling, 1990).

Ringed seals spend much of the summer and early fall in the water feeding. Ringed seals eat a variety of invertebrates and fish. The particular species eaten depends on availability, depth of water, and distance from shore. In Alaska waters, the important food species are Arctic cod, saffron cod, shrimps, and other crustaceans. Feeding is greatly reduced during the molt (ADF&G, 1994).

Spotted Seal. The spotted seal (*Phoca largha*) is commonly seen in coastal waters of northern Alaska during ice-free seasons. The name is descriptive of its markings, consisting of numerous dark, irregularly shaped spots (sometimes encircled by a faint ring) on a lighter background, usually of a brownish yellow color. Spots are most numerous on the back and upper flanks (ADF&G, 1994).

Spotted seals enter the sale area in July. Spotted seals are known to haul-out on the outer islands of the eastern Colville River Delta. Spotted seals move out of the Beaufort Sea from September to mid October as the shorefast ice reforms (Ott, 1997).

They are annual breeders, and mating occurs in late April to early May. Pupping occurs anytime from early April to the first part of May, although the peak is during the first two weeks of April. Pups are nursed for 3 to 4 weeks, during which time they more than double in weight. Adult females mate about the same time their pups are weaned (ADF&G, 1994).

They eat a varied diet; principal foods are schooling fishes, although the total array of foods is quite varied. There are geographical and seasonal differences in their prey. Along the coast spotted seals feed on herring, capelin, saffron cod, some salmon (especially in lagoons and river mouths) and smelt (ADF&G, 1994).

Bearded Seal. The bearded seal (*Erignathus barbatus*) is the largest seal normally found in the seas adjacent to Alaska. The majority of the bearded seal population in Alaska is in the Bering and Chukchi seas. In the Beaufort Sea the bearded seal is primarily restricted to moving ice during the summer (MMS, 1996a: III-B-7). Bearded seals generally occur in the Beaufort Sea from July through October, and are primarily associated with the pack ice edge (Ott, 1997).

Female seals are able to breed successfully at age 5 or 6. Males become sexually mature at 6 or 7 years. Bearded seals commonly become reproductively active before they attain maximum growth. The incidence of pregnancy in adult females is about 85 percent. During April, adult male bearded seals begin underwater "singing." The song is a highly characteristic and complex frequency modulated whistle, parts of which are audible to humans. Hunters are sometimes guided to a seal by its whistle (ADF&G, 1994).

Females bear a single pup, usually during late April or early May. The average weight of pups at birth is around 75 pounds and average length is about 52 inches. By the end of a brief nursing period lasting from 12 to 18 days, pups increase their weight almost three times, to around 190 pounds. This gain is due mainly to an increase in thickness of the blubber layer (ADF&G, 1994).

Bearded seals eat a wide variety of invertebrates and some bottom fishes. The main food items are crabs, shrimp, clams, and snails (ADF&G, 1994).

Walrus. Pacific walrus are the largest pinnipeds in arctic and subarctic seas. The majority of the North Pacific walrus population occurs west of Barrow, although a few walrus may move east throughout the Alaskan portion of the Beaufort Sea to Canadian waters during the open water season. They are most commonly found in relatively shallow water areas, close to ice or land. The genus name for the walrus, *Odobenus* (meaning tooth-walker), refers to one of their most prominent characteristics, their tusks. These tusks, which are elongated upper canine teeth, are present in both males and females. They are huge animals; adult bulls often approach 2 tons in weight, and the females may exceed 1 ton (ADF&G, 1994).

Most females do not begin to breed until 6 or 7 years of age. Mating occurs during January and February, but growth of the fetus does not begin until about mid-June. This delay in fetal growth is thought to occur in all pinnipeds. Walrus calves are born mostly in late April or early May during the spring migration. They weigh 100 to 160 pounds at birth. Calves are dependent upon their mothers for at least 18 months and occasionally for as long as 2-1/2 years (ADF&G, 1994).

Cows will not abandon their calves, and vice versa. The cows make every effort to rescue their offspring. They often carry their dead calves away from the hunters. Walruses, especially young males, will push dead and badly wounded animals (often larger than themselves) off an ice floe, out of the reach of the hunters (ADF&G, 1994).

Walruses feed mainly on bottom dwelling invertebrates. Major food items include several different kinds of clams. The rejected shells can be found on the sea floor alongside the holes and furrows made by feeding animals. Other food items include snails, crabs, shrimps, worms, and occasionally seals. Walruses usually find food by brushing the sea-bottom with their broad, flat muzzles. The tusks are probably not used to any great extent during feeding (ADF&G, 1994).

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Chapter Four: Current and Projected Uses of the Sale 87 Area

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Chapter Four: Current and Projected Uses of the Sale 87 Area

A. Historical Background

Evidence of human occupation and use of the Arctic coastal plain dates back to 10,000 BC. Marine mammal harvesting on winter sea ice has occurred for at least four thousand years, and evidence of whaling is 3,400 years old (Langdon, 1996). The record of human existence on the North Slope is characterized by several distinct cultural periods marked by changes in tool style (NSBCMP, 1984a:2-1). The environmental characteristics of the Arctic shaped Inupiat culture into a semi-nomadic society with a tradition of whaling and an emphasis on seasonal inland hunting. This pattern of land use remained unchanged until the second half of the 19th century with the arrival of westerners, new tools, and due to natural events, such as caribou population decline (NSBCMP, 1984a)(NSB, 1979).

Numerous sites across the North Slope containing sod houses, graves, storage pits, ice cellars, bones and relics attest to the historical use and presence of Arctic people in the Sale 87 area, however, much of the archaeological record has been destroyed by erosion (Hoffman, et al., 1988). For centuries, trading centers, like Barter Island and Nigalik, at the mouth of the Colville River, were used by Canadian and Alaskan Eskimos (Jacobson & Wentworth, 1982). Eskimos of the North Slope also traded with Asia across the Bering Strait as early as the mid-1700's (Langdon, 1996) (NSBCMP, 1984a).

European explorers and fur traders began arriving in the Sale 87 area in the 1820s and 30s. This contact introduced metal tools, traps, and guns to support trading and hunting. Russian trading posts were established from Norton Sound southward. After bowhead whale migration paths were discovered, commercial whaling increased dramatically in the Arctic after 1850 and into the 1880's. Several whaling stations were built along the coast providing for regular contact and trading with Natives. Steamships replaced sailing vessels facilitating year round access. Increased hunting pressure and a natural decline reduced the population of the western caribou herd, and this coupled with western diseases, like measles and influenza, resulted in an increase in the death rate of the inland Eskimo. Coastal Inupiat also suffered population decline from foreign diseases (NSBCMP, 1984a)

By World War I, declining whale populations and decreased demand for whale oil and baleen brought an end to the commercial whaling period. However, demand for fur, particularly Arctic fox, resulted in continued presence of westerners along the Beaufort Coast and North Slope. Native residents engaged in trapping which provided income for non-subsistence resources. By 1914, trapping camps used in the thriving fur trade were established from Barrow to the Canadian border (NSBCMP, 1984a)(Hoffman, et al., 1988:8). In the 1930's, the price of fur plummeted which forced many traders to leave the region near the lower Colville River. Many residents moved to other settlements in Alaska (Hoffman, et al., 1988).

World War II brought an influx of military personnel into Alaska and the petroleum exploration period began. Inupiat were hired to work on construction projects, including the Naval Arctic Research Laboratory near Barrow in 1947, and the Distant Early Warning (DEW) line defense sites in the early 1950's (NSBCMP, 1984a). Before 1950, the lower Colville River supported many families, until the Bureau of Indian Affairs required that children attend schools, and most residents relocated in Barrow (NSB, 1979).

The contemporary period of modernization and change began in the 1960's. The discovery of the Prudhoe Bay oil field in 1967 prompted a renewed interest in petroleum exploration and development, but before oil reserves could be developed, Native land claims had to be settled. "In response to rapid change that

threatened Native land rights through land transfers, biological resource limitations, and natural resource leasing (primarily oil and gas), Inupiat political groups formed regional organizations to protect their rights and culture” (NSBCMP, 1984a:2-8). The Alaska Native Claims Settlement Act was passed in 1971 which created village and regional Native corporations and provided a mechanism for the transfer of land ownership to Native Alaskans (NSBCMP, 1984a). In 1973, 27 families of Kuukpikmiut (People of the Lower Colville) ancestry left Barrow and resettled Nuiqsut village (NSB, 1979)(Hoffman, et al., 1988).

Prior to the building period of the late 1970’s and 1980’s, few services were provided to residents, few jobs were available, and living conditions were austere across the Arctic Slope of Alaska. All communities lacked sanitation services, running water, telephones in homes, community centers and modern recreation facilities. The incorporation of the North Slope Borough in 1972 provided residents with local government powers and a mechanism to assess and tax oil and gas infrastructure. Incorporation also created responsibilities of planning, zoning, education and utilities. Petroleum revenues and other funding have provided the North Slope Borough with resources to pay for schools, fire stations, medical clinics, health care services, utilities, public safety facilities, family assistance programs, workforce development programs, community centers, public housing, administrative facilities, and jobs for borough residents (NSB, 1993).

B. North Slope People and Economy

The entire Arctic coastal plain of Alaska from the northern foothills of the Brooks Range to the Beaufort Sea, and from Point Hope on the Chukchi to the Canadian border is contained within the North Slope Borough’s 94,770 square miles; an area about the size of Oregon. The financial and population center of the borough is located at the city of Barrow, incorporated in 1958. Other communities or villages within the borough include Point Hope, Cape Lisburne, Point Lay, Wainwright, Atkasuk, Nuiqsut, Kaktovik, Anaktuvuk Pass, and Deadhorse (ADCRA, 1995).

Three communities are within or near the Sale 87 area: Nuiqsut, Kaktovik, and Anaktuvuk Pass. Nuiqsut is located within the sale area on the Colville River delta, Kaktovik is located about 70 miles to the east of the sale area on the north shore of Barter Island and Anaktuvuk Pass is located approximately 85 miles south of the sale area in the central Brooks Range. These villages are likely to feel the greatest impact on subsistence activities from the sale. If reserves are discovered and developed, all Alaskans may experience the economic effects of Sale 87 through permanent fund dividends, and state services and programs funded by petroleum revenues.

Barrow is located more than a 100 miles to the west of the Sale 87 area. Although numerous businesses in Barrow provide support services to oil field operations, residents are not likely to be affected by the sale, unless they harvest subsistence resources in the Sale 87 area, are employed by local government, or work with or in the oil and gas industry. For a discussion of the reasonably foreseeable fiscal effects of the sale, see Chapter Five.

1. Population and Housing

As of July 1996, the Alaska Department of Labor estimates the 1996 NSB population to be 7,157; a 2.9 percent increase from 1995. In the previous year, the borough population was 6,950; a 16 percent increase from 5,979 in 1990 (ADOL, 1996a). Seventy-two percent of NSB residents are Native Alaskan Inupiat Eskimos. The 1990 U.S. Census estimated there were 2,153 housing units in the borough, 22 percent of which were not occupied. Nearly 1,000 housing units were being rented with a median monthly rent of \$600. In the 1990 census year, one in three adults were not in the wage earning portion of the economy (ADCRA, 1995).

Barrow was home to 4,276 residents in 1996; 64 percent of whom are Native Alaskan. Barrow's population grew an average of 4.2 percent per year between 1990 and 1996 (ADOL, 1996a). This rapid natural increase in population has resulted in a large proportion of Barrow's population being of school-age. Of the 1,110 students in Barrow schools, two-thirds are at the elementary level (ADCRA, 1995).

Anaktuvuk Pass is home to 306 residents, up eighteen percent from 1990. In 1995, one hundred and nine students attended the local school (ADCRA, 1997). In 1990, there were 81 housing units in Anaktuvuk Pass, of which 41 were owner-occupied. Median home value (owned) in 1990 was \$100,000. Of all housing units, 65 were single family homes, four were multi-unit structures, and one was a boat (ADCRA, 1995).

Nuiqsut was home to 410 residents in 1995, up sixteen percent from 1990 (ADCRA, 1995). In 1993, nearly one-third of all residents were under the age of 10 (ADF&G, 1995) and in 1995, 137 students attended Nuiqsut Trapper School (ADCRA, 1995). In 1990, there were 102 housing units in Nuiqsut, of which 57 were owner occupied. Thirty-four units were being rented with a median monthly rent of \$300. Median home value (owned) in 1990 was \$83,200. Of all housing units, 94 were single family homes, three were three-to-four unit structures, and the rest were boats or some other type of structure (ADCRA, 1995).

Kaktovik was home to 210 residents in 1995, down slightly from 1990 (ADCRA, 1995). In 1992, about 23 percent of Kaktovik residents were under the age of 10 (ADF&G, 1995) and in 1995, fifty-eight students were enrolled in the local school (ADCRA, 1995). In 1990, there were 82 housing units in Kaktovik, of which 36 were owner occupied. Thirty-one housing units were being rented with a median monthly rent of \$289. Median (owned) home value in 1990 was \$85,800. Of all housing units, 73 were single family homes, four were trailers or mobile homes, and the rest were some other structure type (ADCRA, 1995).

Deadhorse, the industry support community located near the center of the Prudhoe Bay-Kuparuk oil fields was settled during the development years of the 1970's. The transient work force is not counted by the U.S. Census, because they reside in other communities. According to the Department of Community and Regional Affairs, Deadhorse/Prudhoe Bay is home to just 71 residents. About four to five thousand employees work at the Deadhorse industrial complex, but only a small number are considered full time residents (ADCRA, 1995, ADOL, 1996a).

2. Transportation and Utilities

Barrow is an historic trading center for Arctic Alaska. Transportation in winter is accomplished via snow machine over trails which connect villages and campsites. Dogsleds are also used for transportation. In summer, boats navigate rivers. Air transportation links all communities on the North Slope year-round. Barrow residents get their electric power from the member-owned Barrow Utilities & Electric Cooperative, which also operates the city's water and sewage treatment plant, and distributes natural gas for heating to nearly every household. About half of Barrow households are connected to a public sewer system, and the other half use honeybuckets (ADCRA, 1995).

Anaktuvuk Pass has an airstrip owned and operated by the NSB and provides the community with year-round access. There is no road to Anaktuvuk Pass, iCat-trains[®] transport cargo from the Dalton Highway during the winter months. Electricity is provided by the North Slope Borough Power and Light system. Almost 80 percent of the homes have running water; flush toilets and showers are planned for all residences (ADCRA, 1997).

Transportation to and from Nuiqsut is provided by an airstrip year-round and snow machine or ice road in winter. In summer, river boats navigate down the Colville River to the Beaufort Sea or upriver to Umiat via the Colville, Itkillik, Chandler, Anaktuvuk and other rivers. Nuiqsut residents derive electric power

from a NSB Power & Light System. Over 70 percent of homes have complete plumbing. Residents have individual water tanks and water is supplied by a public surface water system. Ninety-seven percent of homes are heated with fuel oil or kerosene. The community has no sewer system, and residents must use honeybuckets, however, a water and sewer project to provide running water, flush toilets, and showers to residents is underway (ADCRA, 1995).

Air travel provides year round access to Kaktovik via the Barter Island Airport, owned and operated by the U.S. Air Force. Kaktovik residents derive electric power from a NSB Power and Light System. Currently, the community has no sewer system, and residents must use honeybuckets; funding for flush toilets, showers, and plumbing is pending. Fresh water is derived from a surface source, and is treated and stored in a 680,000 gallon water tank. Water is then delivered by truck to households. (ADCRA, 1995).

Deadhorse is located near the terminus of the Dalton Highway on the Beaufort coast, which provides year-round access to Fairbanks and beyond. This community is serviced by jet aircraft, and also marks the start of the Trans-Alaska Pipeline. Deadhorse derives its electric power from the burning of natural gas at two main power generation facilities, and from waste heat generated from oil and gas processing. This electricity is distributed via utility lines to Kuparuk oil field in the west, and Endicott to the east. Freshwater is obtained from nearby lakes, and all wastewater is treated before discharge into ponds. (ADCRA, 1995).

3. Occupations and Earnings

Local government is the largest employer of NSB residents, yielding one in three full-time positions. In 1990, local government provided 1,454 jobs, the private sector employed 891, federal government employed 177, and state government employed 60. Of those engaged in wage earning positions, more than half were employed in the administrative and health services sector. In 1990, thirty-five percent of the borough's 2,531 residents were old enough to participate in the wage earning work force, but did not (ADCRA, 1995). A 1993 survey revealed that for all communities in the borough, except Barrow, more than one in three residents indicated they were involuntarily under-employed (NSB, 1993). Self-employment and non-paid activities provide other occupations. Seven residents held commercial fishing permits in 1995. Median household income in the borough was \$50,473 in 1990 (ADCRA, 1995).

According to the Alaska Department of Labor, more than \$485 million was earned in the NSB in 1995. Government payrolls accounted for about 20 percent of that (almost \$105 million), and the oil and gas extraction industry accounted for approximately 55 percent (\$267 million). More than \$29 million went to construction workers, \$27.5 million were earned in the transportation, communications, and utilities sector, and more than \$30 million went to the services sector, mostly in the business services segment. The 1995 earnings from local government exceeded \$99 million (ADOL, 1996b). See Chapter Five "Fiscal Effects" for additional information on NSB employment.

Median household income for Anaktuvuk Pass was \$37,292. Local government is the largest employer, providing 48 jobs out of a total workforce of 84. Economic and employment opportunities in Anaktuvuk Pass are strongly influenced by its isolation. Hunting and trapping for the sale of skins, guiding hunters, or making traditional caribou skin masks or clothing provide income (ADCRA, 1997).

The median household income for Nuiqsut was \$32,188; a 14.4 percent increase from 1980. Cash employment in Nuiqsut is limited, due in part to its isolation (ADCRA, 1995). Nearly two thirds of the wages earned in Nuiqsut in 1993 came from local government which provided more than 55 percent of all wage earning jobs in the community. Eighty-five percent of households had one or more members employed in local government, 32 percent had members employed in construction, almost 20 percent had members employed in the finance, insurance, and real estate sector, and 16 percent of households had members

employed in the trade industry (ADF&G, 1995). For all households in the community, average gross income in 1993 was \$56,629. Of the estimated 176 adults in the community, those who participated in the wage earning portion of the economy had worked between two and three jobs (ADF&G, 1995).

Median household income for Kaktovik was \$42,265 in 1990, a 9.4 percent increase from a decade earlier. Cash employment in Kaktovik, like Nuiqsut and other remote villages is also limited (ADCRA, 1995). Nearly 80 percent of the earned income for the community came from local government which provided more than 60 percent of all wage earning jobs in the community. In 1992, nearly every household in Kaktovik had one or more members employed in local government, 35 percent had members employed in the finance, insurance, and real estate sector, and 15 percent had members employed in the trade and manufacturing sector (ADF&G, 1995). For all households in the community, average gross income in 1992 was \$55,688. Of the estimated 129 adults in the community, the number of jobs per person averaged 2.34 (ADF&G, 1995).

Deadhorse's four to five thousand employees work and live in the surrounding oil field complex. Most oil industry employees work 12-hour shifts, seven days a week, on a two-week-on, two-week-off schedule. Permanent residents of the community are employed principally in the wholesale trade, retail trade, mining (oil and gas extraction), and personal services industries (ADCRA, 1995). The importance of local government in providing services, improving the standard of living, and in providing sources of cash and employment to residents cannot be overemphasized. For detail on NSB and municipal government finance, see Chapter Five.

C. Subsistence and the value of fish & wildlife

For a thorough compilation of subsistence base-line information for the Sale 87 area, see Pederson et al., (1985) and (1991); Hoffman et al., (1988); MMS (1995) (1990) and (1987); Jacobson and Wentworth (1982); ADF&G, (1995); NSBCMP (1984a)(1984b) and (1988); and NSB (1997)(1979). For attention to social and cultural impacts, see (MMS, 1995) socioeconomic indicators study, and (NSB, 1979).

1. The meaning and protection of subsistence values

In its most minimal definition, subsistence is sustenance and subsistence uses at least include hunting, fishing and gathering for the primary purpose of acquiring food (Bryner, 1995, citing to Case, 1984). Under title 19 of the North Slope Borough Municipal Code (NSBMC), subsistence is defined as "an activity performed in support of the basic beliefs and nutritional needs of the residents of the borough and includes hunting, whaling, fishing, trapping, camping, food gathering, and other traditional and cultural activities." (NSBMC 19.20.020(67)) ANILCA defines subsistence usage as the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade (16 U.S.C. § 3113) (Bryner, 1995). Subsistence in Alaska is more than harvesting, gathering, processing, sharing, and trading. Subsistence also includes cultural, social, and economic values associated with the taking, use, and exchange of plants, fish and game. Subsistence embodies the essence of Inupiat culture.

Inupiat culture is characterized by strong kinship ties, cooperative efforts, and sharing. Inupiat who maintain a close relationship to the land and perpetuate an understanding of the seasons and animals by educating youth are highly respected. Land and the natural environment is primary and sacred in the Inupiat world view. Names and songs identify the land. Inupiat see man's place in the universe as a member of the world in contrast to a western view where man is placed in this world. The Inupiat view, being a part of the

environment, rather than apart from it, resulted in a subsistence life of complete dependence on the near environment, weather and living resources (NSB, 1979).

Most subsistence resources harvested are shared, traded or given to others. Non-subsistence goods purchased with wages are also shared. Subsistence resources cannot be purchased with money, and they must be "earned" by hunting. On the other hand, subsistence technology, such as boats, all-terrain vehicles, fuel, and gear can be purchased with cash.

The collection, processing, and distribution of subsistence resources nearly always involves some group activity, and thus to Alaskan Natives, subsistence, "... also encompasses a complex web of relationships that define and distinguish their traditional culture." (Bryner, 1995:299). The continued opportunity to engage in subsistence uses is a fundamental component of all Alaska Native cultures, and serves as the keystone to social, ethnic and psychological identity.

Since the discovery of oil in Prudhoe Bay and the advent of oil and gas infrastructure development in the Arctic, village elders, and traditional Inupiat persistently express concerns that subsistence is being threatened. The once open range of the Kuparuk and Sagavanirktok Rivers is now complicated by the presence of above-ground pipelines, spine roads, utility lines, and large facilities. Village leaders affirm that both outside pressures, and pressures within communities are challenging the system of values which has bonded them together (NSB, 1979).

Some western institutions have been willfully adopted into village life, such as education, health care, and economic necessities, like home building materials and fuel (NSB, 1979). Others have not, such as some fish and game regulations. For example, catch and release fishing, may be considered disrespectful in some Native cultures (Noland & Gallagher, 1989). Imposed seasons and bag limits restrict the taking of game, like caribou, which were previously harvested year-round (Jacobson & Wentworth, 1982). Many traditional hunting, fishing, and gathering sites are on federally or state managed land. Private and public ownership of lands and waters tells people where, when, and sometimes how they may hunt.

The Nuiqsut Cultural Plan (NSB, 1979), published just after the construction of the Trans-Alaska Pipeline, identified forces converging upon the Inuit culture: competing interests, oil and gas development, environmental degradation, access and use limitations, land tenure problems, socio-economic instability, and loss of cultural privacy (NSB, 1979). All of these forces pose a threat to subsistence life and the traditional Inupiat culture.

To assure subsistence is protected, the locations of harvest areas and sites, and the harvest and participation levels (demand for resources) must be identified. Also, it is essential and legally mandated that healthy populations of fish and wildlife be conserved. When it is necessary to restrict the taking of fish and wildlife, subsistence uses are given priority over all other consumptive uses. Federal and state laws regulate subsistence use, access, and the trading of subsistence resources. On federal lands, the federal government is required by Title VIII of ANILCA (1980) to provide a subsistence priority for rural Alaskan residents unless the state provides this priority through its laws. Subsistence use and allocation of fish and game is codified in state law under AS 16.05.258. Subsistence uses in Alaska are regulated by the U.S. Fish and Wildlife Service, Office of Subsistence Management, and the Alaska Department of Fish and Game, Division of Subsistence. For a discussion on the effects of this lease sale on subsistence uses, see Chapter Five.

2. Subsistence and the mixed-cash economy

ADF&G conducts subsistence harvest surveys of communities throughout Alaska, and results are compiled in a computer database. Indicators tracked by ADF&G help to describe how the modern subsistence

economy is functioning. Some indicators include species availability and abundance within traditional subsistence harvest zones; and levels of participation by community members in subsistence harvesting. These are discussed in some detail below. Another indicator characterizing the cash-non-cash economic mix is the amount and distribution of cash income among residents of the area or community. This varies among communities, depending on subsistence resource availability and the availability of jobs. The costs and availability of goods and services in a community also affect the cash-non-cash mix. In 1993, the cost of a standard market basket of food goods was 2.19 times higher than in Anchorage (ADF&G, 1995).

The relationship between earning cash wages and engaging in subsistence activities is different for each individual, and depends on individual life choices and the flexibility of the available wage employment. Many residents choose to work seasonally, part-time, or just temporarily. Use preferences of individuals depend on cash availability (cash for supplies and transportation), job or village responsibilities, and resource preferences (NSB, 1979:30). Those who choose to hunt are likely to benefit from shared resources derived from wage earners, and vice versa (NSB, 1979) (Jacobson & Wentworth, 1982). Residents holding cash paying positions conduct subsistence activities during non-work periods, weekends, and vacations (NSBCMP, 1984a).

Employment for wages, including full-time, part-time, temporary, and seasonal positions have both advantages and sacrifices for village residents. Wages provide residents with cash necessary to function in modern village communities, and provide families with money for housing and associated costs. The increase in job opportunities created by the NSB has resulted in more disposable income in the communities of the NSB. However, generally time spent earning cash wages is time not spent engaging in subsistence activities (Bryner, 1995). Employers are encouraged to provide residents with the opportunity to participate in subsistence activities during key seasonal events, such as fall whaling, without losing their jobs.

A small percentage of full-time oil industry jobs on the North Slope are held by local residents. This is partly explained by the small labor supply of the NSB relative to the large labor demands of industry. While some full-time oil industry positions may be available in a community, the social costs of not participating in the traditional portion of the village economy may be greater than the cash benefits and income stability derived from participation in an oil field development labor force. The remoteness of villages with respect to oil field infrastructure coupled with long shift hours means that employees are more likely to be separated from their families and children.

3. Seasonal cycle of economic activity and subsistence use areas

Seasons on the Arctic coast are marked by the arrival and departure of sea ice, river ice, and changing winds. After the break-up of river ice and the retreat of fast ice along the shoreline, the tundra thaws and mobility is mostly restricted to open waterways and established trails. Seasons are also marked by the arrival and departure of migrating caribou, waterfowl, and the bowhead whale. In the summer, the primary mode of transportation is by small skiff (14 to 18 ft), which can navigate the shallow channels of the river deltas and lagoons, and by ATV for overland access. In winter, snow machines and, to a lesser degree, dogsled teams provide transportation to hunting and fishing camps and trade fairs. Historical subsistence access routes on the North Slope follow all major rivers and skirt the coast from the Canadian border to Wainwright and beyond. The seasonal cycle of subsistence harvesting is portrayed in Figure 4.1. Subsistence use areas in the Sale 87 area are depicted in Figure 4.1.

For residents of Nuisquit, fishing occurs both during the summer and in the fall when the ice first becomes thick enough for snow machine travel. In June, after the ice goes out, broad whitefish move upriver. Two to four weeks after break-up, when muddy waters clear, fishing begins (Hoffman, et al., 1988:15).

Residents travel from the village to fish camps along the river channels and fish and hunt for several days. Often several family members participate in the fishing activity, and family members employed in wage earning positions may travel to the fish camp on weekends (George and Nageak, 1986:14). Important traditional use sites along the lower Colville include Uyagagviit, and Nigliq (Nannie Wood's Camp), which according to Nuiqsut Vice-Mayor Leonard Lampe (1996) has hosted subsistence fishers and trappers since the late 1940's. Numerous other sites in use today are recorded in the NSB Traditional Land Use Inventory. Some important traditional use sites are depicted in Figure 4.2. (Hoffman, et al., 1988)(NSB, 1979)(ADF&G, 1986)(Jacobson & Wentworth, 1982).

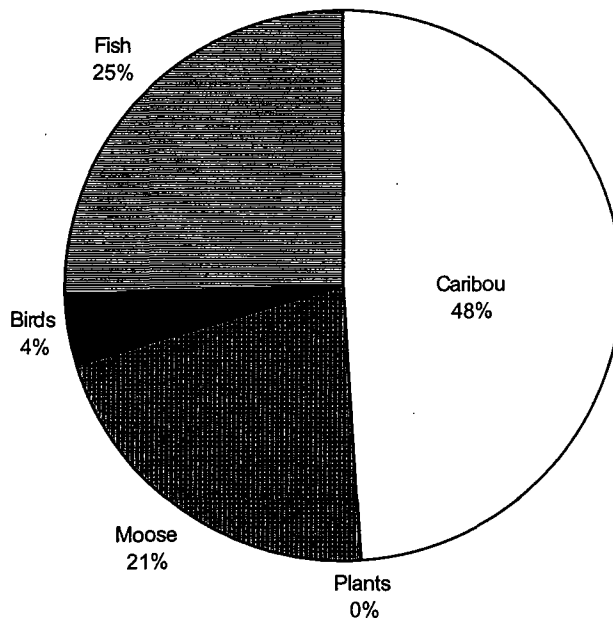
Geese and King Eider ducks fly low from west to east across the deltas, along the coast in June, and are hunted with shotguns (Hoffman, et al., 1988). Caribou of the Central Arctic Herd (CAH) approach the Colville Delta in late May and early June, and calve in the area between the main channel of the Colville and Sagavanirktok River deltas. Also during June and into July, moose travel north along the upper Colville and Itkillik Rivers where they may be harvested later in the fall (Hoffman, et al., 1988).

Summer fishing with gill nets lasts throughout the open water season, from early June to mid-September with the broad whitefish being the preferred and most numerous species caught. Species harvested are the Arctic char, whitefish, cisco, burbot and grayling. A few chum and pink salmon are also taken. Gill nets account for almost all the fish caught (ADF&G, 1995). Grayling may be caught with rod and reel or with nets in creeks. Hunting of ringed and bearded seal begins in July in the open water off the delta and continues throughout the summer months (Hoffman, et al., 1988:16).

Figure 4.1 Seasonal Use Harvest Activities

Figure 4.2 Subsistence Use Areas and Sites

**Nuiqsut Subsistence Harvest
in Edible pounds by Category
July 1, 1994, to June 30, 1995**



The harvest of plants accounted for less than 1% of the edible pounds in the subsistence harvest.
Source: NSB, 1997:15

In the fall, the fish harvest consists mainly of least and arctic cisco, though other species of fish are also caught, and generally lasts only two to three weeks. The rate of fish harvest is significantly higher in the fall than during the summer season (George and Nageak, 1986: 16) when Arctic char and salmon begin their migration upriver. Small whitefish and Arctic cisco are harvested near the ocean, but these species do not move far upriver. Spotted seals, valued for their skins follow the salmon and char upstream, where they are hunted as far south as the confluence of the Itkillik and Colville Rivers. Near the end of August is the optimum time to harvest caribou. At this time, caribou are fat from grazing all summer and fit for their long migration south. The hide is in good condition for making clothing and it is before rutting season; a time when the bulls are not good to eat (Hoffman, et al., 1988). As in Kaktovik, blueberries, cloudberry, cranberries, wild potato and wild rhubarb are harvested (Jacobson and Wentworth, 1982).

In September, caribou begin moving down the Ublutuoch River, and east across the Colville, before heading south toward the Brooks Range. After calving, caribou from the CAH move toward the Sagavanirktok and follow it south to the mountains. Arctic cisco and small whitefish run upriver just before freeze-up (Hoffman, et al., 1988). Residents hunt moose in an area between the village and the confluence of the Anaktuvuk and Colville Rivers. However due to a steep decline in moose populations on the North Slope, residents may need to travel further upriver for a successful harvest (Carroll, 1996).

For Nuiqsut, whaling begins in the first week of September. Whaling teams travel by boat down the Colville River through Simpson Lagoon and set up camp at Cross or Nora Island; a trip that takes about eight hours according to whaling captain Frank Long (1996). From there, teams in either skin boats or moderately sized skiffs, travel as quietly as possible into the Beaufort Sea, north, northeast, and east of Cross Island as far as 44 miles out (Long, 1996) into the fall migratory path of the bowhead whale. A well known whaling captain and former mayor of the NSB describes the method; "During the fall hunt, boats move at very low speeds until a whale is spotted." (Ahmaogak, G., 1996b). Whaling boats based out of the Cross Island camp as long as two weeks or more. Often, seas are rough, and the further offshore crews must travel to find whales, the greater the risk. Ringed and bearded seal, king eider, caribou and polar bear may also be hunted during whaling expeditions (Hoffman, et al., 1988). After a whale is struck, it is towed to Cross Island, pulled onshore with a winch, and butchered. Then, the whale is transported by boat to Nuiqsut, or to West Dock or Endicott and trucked to Olitok Point (Long, 1996). Historically, whole villages have participated in the processing and distribution of whales taken from the Beaufort Sea. The whale is shared during potlucks throughout the year, and at Thanksgiving, Christmas, and "Nalukataq"; the harvest feast where fish, caribou, whale meat, and muktuk is portioned out to every member of the community (NSB, 1997:30)(MMS, 1996)(Jacobson & Wentworth, 1982).

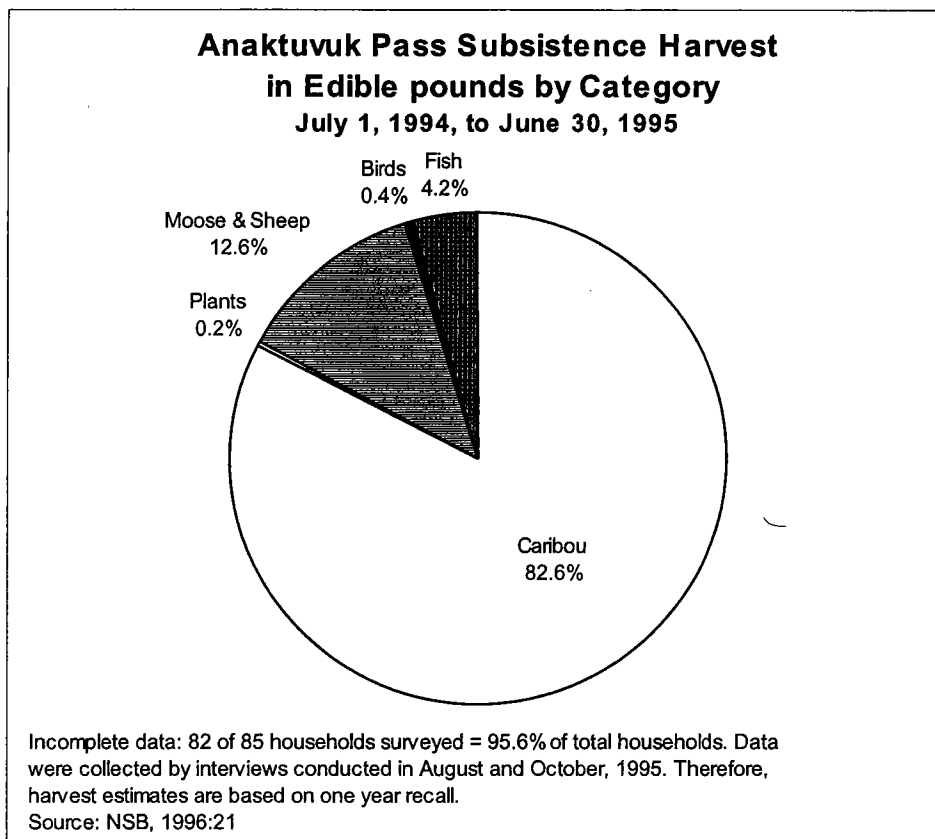
In 1996, Nuiqsut harvested two whales (about 4 miles north of Narwhal Island), and transferred the remainder of their quota to Barrow, because two was enough to feed the community (AEWC, 1997). This general description of traditional whaling is included here because of its importance to Inupiat culture. However, whaling should not be affected by Sale 87 activities because it is a totally onshore sale.

After the rivers freeze by mid-October, residents travel by snowmachine to fish camps on the Colville River or Fish Creek to fish for Arctic cisco and small whitefish (Hoffman, et al., 1988). Ice fishing is accomplished by cutting holes in the ice, and then stretching gill nets under the ice (George and Nageak, 1986: 16). Hook and line is used to ice fish for lingcod and grayling. Some moose and caribou hunting may occur during October and November (Hoffman, et al., 1988). Polar Bears are hunted from October to May (NSB, 1979).

In December, Arctic fox, cross fox, red fox, wolves, and wolverine are trapped or shot. Some caribou and moose may be harvested, and seals taken in the remaining open leads of sea ice. From January to March, trapping continues, and some hunting of caribou and moose may occur, depending on the depth of the snow and ability to move about (Hoffman, et al., 1988).

Mid-April brings an end to trapping season. Hook and line fishing for lingcod and lake trout resumes. The hunting of wolf and wolverine by rifle is accomplished by snow machine, and seals sunning themselves on the sea ice are also harvested year round. These conditions persist through May until the river ice again washes out to sea, completing the annual cycle of subsistence harvest (Hoffman, et al., 1988).

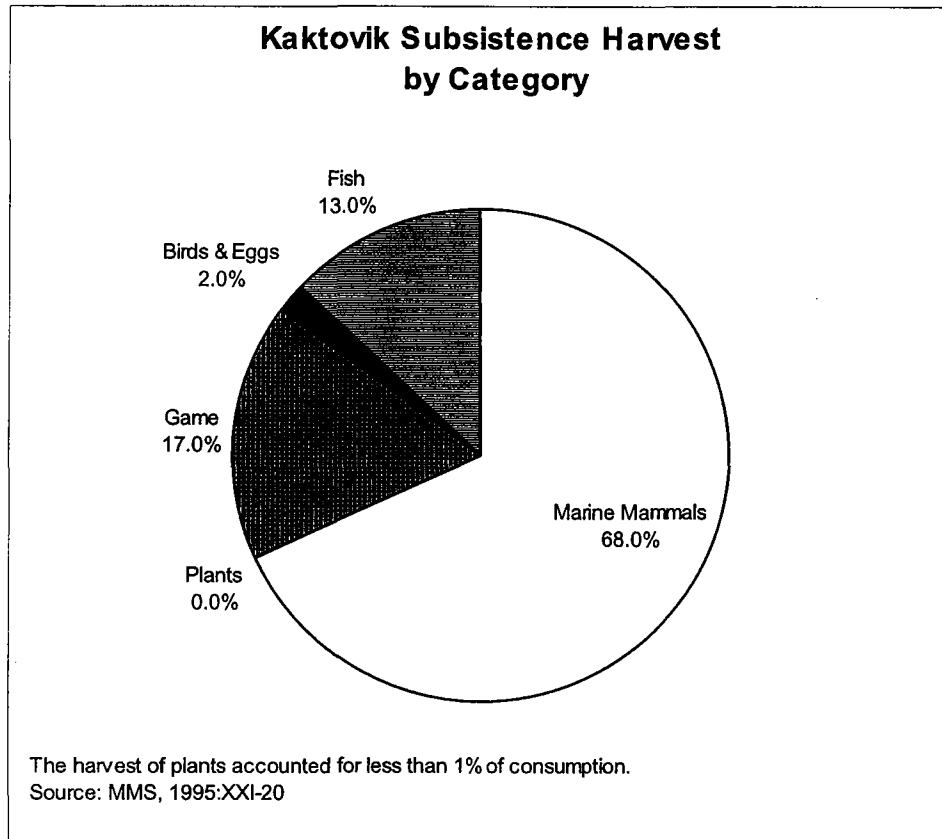
Anaktuvuk Pass residents mainly use the river corridors of the Colville, Itkillik, and Anaktuvuk rivers for subsistence activities within the sale area (Pederson, 1997). The annual subsistence cycle of Anaktuvuk Pass revolves around the caribou. In a survey conducted by the North Slope Borough Department of Wildlife Management, caribou accounted for 82.5†percent of the harvest in edible pounds for a one year period. The reported number of caribou harvested during the study period (July 1, 1994, to June 30, 1995) was 311. This is low when compared with previous years for which harvest data are available. For example, in 1990-91, the estimated harvest was 592; in 1993-94 it was 574 (NSB, 1996:13).



Intensive caribou hunting occurs in April and May as animals move through the Brooks Range on spring migrations northward. Caribou hunting intensifies again in the fall as the animals begin to move southward. During the winter caribou are occasionally hunted, but they are in less desirable condition at this time of year (ADF&G, 1986:571).

Fish and birds are considered of minor subsistence value to Anaktuvuk Pass residents but are crucial during times when other resources are scarce. Important fish species include grayling, Arctic Char, lake trout, and whitefish. Anaktuvuk Pass residents do not harvest many ducks or geese compared to hunters in other North Slope villages because waterfowl in the central Brooks Range are generally scarce. The types of birds harvested include Oldsquaw, pintail, and White-fronted geese. Ptarmigan are considered the most important species and are harvested year round (NSB, 1996:15).

Kaktovik subsistence harvest areas range from east of the Canadian border to Camden and Mikkelson Bays. Traditional Land Use Inventory sites are discussed in Jacobson and Wentworth (1982). Important locations in the Kaktovik Traditional Land Use Inventory (TLUI) in or adjacent to the sale area include Flaxman Island, Brownlow Point, and Tigutaaq at the confluence of the Tamayariak and Canning Rivers. The primary early winter camps of Kaktovik people are located along the Hulahula and Sadlerochit Rivers (Jacobson and Wentworth, 1982).



The annual cycle of subsistence activity for Kaktovik is similar to that of Nuiqsut; the same species are harvested at the same time, but from different lakes, rivers, uplands, islands, estuaries, and marine waters. Residents travel to the mountains to hunt wolf, sheep, wolverine, and moose in March. April and May are important months for the taking of ground squirrel, ptarmigan, and marmot. In late May and early June, residents camp in the Camden Bay area to hunt migrating waterfowl, such as eider and brant. By June, mobility is increasingly restricted due to spring thaw. Birds, seals, and caribou are hunted closer to Barter Island. After calving in late May and early June, caribou of the Porcupine herd graze about the area between the Canning River and the Mackenzie River delta. By late June, land travel is restricted, and the sea ice still remains. In July, the sea ice goes out, and hunting of caribou, and fishing of arctic char with nets is accomplished by boat. In the fall, caribou begin moving toward winter habitat on the south side of the Brooks Range. The month of August is good for fishing char and arctic cisco (Jacobson and Wentworth, 1982).

4. Harvest levels of plants, fish and game, species variety and participation levels

Factors affecting subsistence harvests include: the availability of fish and wildlife populations, weather, terrain, methods of harvest, availability of transportation, state and federal hunting and fishing regulations, local economic conditions, availability of cash for supplies and transportation (Jacobson and Wentworth 1982:30) (Pederson, Coffing, and Thompson, 1985:15), the changing condition of the meat, hide or fur (Jacobson and Wentworth, 1982:29), and community needs. Soggy tundra and shallow rivers restrict most summertime activities to coastal areas, but frozen ground, snow cover, ATVs, and snow machines expand harvest areas during the winter.

Subsistence resources are shared between wage earning and non-wage earning members of the community as well as with relatives and others living in North Slope communities, Fairbanks and Anchorage. While families in the 1980's were smaller than in previous periods, all family members are still engaged in subsistence activities and sharing (NSBCMP, 1984a:2-20).

Fish, caribou and bowhead whales comprise the bulk of the nutritional needs of the Inupiat (ADF&G, 1995) but other animals are also important for both their nutritional and cultural uses. The harvesting of certain animals, like wolf and wolverine, have different value than other animals.

Nuiqsut residents harvested an average of 741.8 pounds per person of usable subsistence resources for home use and non-commercial exchange between households in 1993 (See Table 4.1). Fish comprise nearly a third of the subsistence wild resource harvested by Nuiqsut residents, land mammals another third, and marine mammals also a third. Birds and eggs accounted for about 2 percent of the community harvest (ADF&G, 1996a).

Species harvested in the Sale 87 area include salmon, cod, rainbow smelt, burbot, arctic char, arctic cisco, least cisco, lake trout, grayling, sheefish, whitefish, brown bear, polar bear, caribou, moose, muskox, arctic fox, red fox, ground squirrel, wolf, wolverine, weasel, marmot, mink, ducks, geese, brant, ptarmigan, sandhill crane, tundra swan, salmonberries, blueberries, blackberries, cranberries, greens, and mushrooms (ADF&G, 1995)(NSB, 1997). On average, Nuiqsut households used more than 20 different kinds of wild resources, about 12 types of resources were shared, and eleven varieties given away (ADF&G, 1996a). Edible pounds harvested from selected resources are listed below.

Table 4.1 Nuiqsut Subsistence Harvests

Nuiqsut Per Capita Edible Pounds Subsistence Resources Harvested, 1993	
Resource	Per Capita Harvest (pounds)
Fish	250.6
Caribou	227.6
Bowhead whale	213
Ringed Seal	20
Moose	12.2
Bearded Seal	3
White-fronted geese	3
Ducks (Eider)	2.9
Canada Geese	2.3
Brown Bear	2
Vegetation and Berries	1.1
Brant	1
Total (including other resources harvested in 1993)	741.8

In the 1985 survey year, subsistence harvests averaged about 400 pounds per person, most of which consisted of caribou and whitefish. At that time, the bowhead harvest was limited, but in the following years, marine mammal harvests gained an increasing proportion of the total subsistence harvest for the community. With the per capita harvest nearly doubling between 1985 and 1993, the importance of Nuiqsut's subsistence harvest is underscored. "This is significant to keep in mind as Nuiqsut's immediate subsistence resource area is presently undergoing intensive oil and gas exploration, and increasing industrial development associated with oil extraction is taking place within Nuiqsut's general subsistence resource area." (ADF&G, 1996a:3)

In 1993, 94 percent of the 242 edible pound per capita land mammal harvest consisted of caribou. Caribou are an important subsistence resource for local residents. An estimated 672 caribou were harvested by Nuiqsut residents in 1993 (ADF&G, 1995), probably from the Central Arctic herd. Caribou are a staple food

that is eaten fresh, frozen, and dried. When available, caribou can provide a source of fresh meat throughout the year. The skins of caribou are used to make blankets, sleeping pads, parkas, boot soles, mitts, and masks. Moose and brown bear hunting also occurs along the Colville River, and nine moose were harvested by village residents in 1993, however, the moose population near Nuiqsut has declined rapidly in this decade. About 600 small land mammals were harvested by Nuiqsut residents in the survey year as well as over 300 ground squirrels, 200 foxes, 31 wolves, about 20 wolverine, and 10 weasels (ADF&G, 1995).

More than half of the 12 pound per capita harvest of birds in 1993 consisted of geese; the remainder consisted of ducks and ptarmigan. Nuiqsut village harvested about two Eider ducks, one brant, two Canada geese, two white-fronted geese, and three ptarmigan per person in 1993. Sixteen snow geese, seven tundra swans, 78 oldsquaw and 25 pintail ducks were harvested by village residents in that year. Additionally, over 100 pounds of Eider duck and geese eggs were harvested by Nuiqsut residents in 1993 (ADF&G, 1995).

In 1993, bowhead whale made up 90 percent of the 236 pound per capita marine mammal harvest. Ringed seals made up the remaining 20 pounds; about one seal for every four people. About six bearded seals were harvested in Nuiqsut. Polar bears are also hunted in the Sale 87 area. Occasionally, walrus may be taken if the opportunity arises (ADF&G, 1995).

In 1993, 46 percent of the 250 pound per capita fish harvest consisted of broad whitefish, 39 percent were either Arctic cisco or least cisco, 7 percent were burbot, 5 percent were grayling, and the remainder included Arctic char and salmon (ADF&G, 1995).

All Nuiqsut households used subsistence resources in 1993. Ninety-four percent attempted to harvest subsistence resources, with 90 percent being successful. Ninety-eight percent of all households in the community received wild resources, and 92 percent gave away wild resources (ADF&G, 1995).

In addition to being personally consumed, a large, but unknown portion of the fish caught are either shared with other communities in the area, or sold. (George and Nageak, 1986: 15). Most Nuiqsut families participate in subsistence fishing activities. The bulk of the fishing in the 1980s was probably done by about half the families in the area (George and Nageak, 1986).

Subsistence resources are utilized for much more than nutrition. Many non-edible parts of the animals harvested are used to make both functional items, and arts and crafts. Driftwood and willow brush are collected for firewood and building materials. Marine mammal bones and hides have also been used to construct temporary shelters and traditional boats. Caribou hides are used for bedding, clothing, and masks. Seal skins are used for carrying water and for covering traditional boats. Whale baleen is decorated and etched into story-telling art works and baskets. Ivory, caribou antler and bone, and whale bones are carved into miniature animals, umiaks, and hunting scenes or made into functional items, like knife or ulu handles and needle cases. Jewelry is made out of many things, including ivory, antler, feathers and imported beads. Bearded seal whiskers are used in making earrings. Wolverine, wolf, polar bear, seal, and fox fur are used to make parkas, slippers, mukluks, and hats, and are used in making dolls, Eskimo yo-yo's, and caribou skin masks. Feathers and skins are used to make drums and many other craft items, such as spirit masks.

It has been estimated that at least one in ten residents of the borough produces arts and crafts. These items may be traded, shared, given away, or sold. Prices of such items vary widely from ten or twenty dollars to thousands. These items are probably made for two basic reasons; for recreation and artistic expression, or to raise cash for a specific purpose, such as an airline ticket, but they are not produced solely for the purpose of generating income in order to perpetuate the craft (Steihn & Hayes, 1996).

D. Other Uses

1. Commercial and Sport fishing

In the entire NSB, seven residents held commercial fishing permits in 1995 (ADCRA, 1995). A commercial fall whitefish fishery is located outside of the sale area on the east channel of the Colville River. This gill-net fishery is the only commercial fishery within the Sale 87 area. In 1995, nearly 6,000 pounds of humpback or broad whitefish were harvested valued at \$4,480 to fishers. In the same year, 9,121 pounds of Arctic cisco worth \$12,541 to fishers were landed (Busher & Borba, 1996).

ADF&G tabulates non-subsistence sport fishing catch and harvest estimates for the entire North Slope drainage area. Fishing effort, catch and harvest for the Sagavanirktok River is also tracked. Most sport fish caught are not harvested, but released back to the water. For example, ADF&G estimates that 1,716 Arctic char were caught on the Sagavanirktok River by sport fishers in 1994, but only 147 were harvested. Similarly, an estimated 2,644 grayling were caught on the river, but only 147 were harvested (ADF&G, 1996b).

2. Sport Hunting, Guiding & Outfitting

Sport harvesting of big and small game in the onshore portion of the sale area is managed by ADF&G, Division of Wildlife Conservation. The state is divided into 26 game management units (GMU). All Arctic ocean drainages between Cape Lisburne and the Alaska-Canada border are contained in GMUs 26A, 26B, and 26C. Unit 26A lies west of the Itkillik River drainage, and west of the east bank of the Colville River between the mouth of the Itkillik River and the Arctic ocean. A significant portion on Unit 26A overlaps with the NPR-A. Unit 26B extends from the eastern boundary of 26A to the west bank of the Canning River, and the west bank of the Marsh Fork of the Canning River. All of Unit 26C is within the Arctic National Wildlife Refuge. It is unknown exactly how many animals of each species are harvested within the Sale 87 area in any given year.

Sport hunting harvest statistics collected by ADF&G are not specific to the Sale 87 area, but estimate the harvest of whole GMUs. Statistics on hunter residency, success rate, mode of transportation, and whether commercial services were used are also collected. Transportation data reflects the mode each hunter used to get to the point where they started walking (ADF&G, 1996b).

Hunting seasons and guidelines are determined by the Alaska Board of Game, and administered by ADF&G. The Prudhoe Unit is closed to big game hunting (5 AAC 92.510), however, residents may sport hunt in other oil fields. The Dalton Highway corridor (extending 5 miles from each side of the highway) is closed to big and small game hunting, except with bow and arrow, and use of motorized vehicles is restricted in the corridor. Firearm possession by industry employees is restricted and workers are not likely to sport hunt in the area during their active-duty shifts. Moose hunting is closed to non-residents on the North Slope (ADF&G, 1996c).

a. Brown Bear.

In the 1994-95 year, 20 brown bears were harvested by 20 hunters in GMU 26A. Of the 36 successful brown bear hunters on the North Slope, 27 used commercial services (ADF&G, 1996b).

b. Caribou.

In the 1994-95 year, 355 hunters took an estimated 1,130 caribou from the Western Arctic Herd (WAH) out of GMU 26A. Harvests of caribou from the Teshekpuk Lake herd were included in the WAH data, and ADF&G believes that there was a high unreported harvest (ADF&G, 1996b).

Of the 583 hunters seeking caribou in GMU 26B, 317 were successful in harvesting 341 animals of the Central Arctic Herd (CAH). Of the successful hunters, 80 used an airplane (25 percent), 214 used a highway vehicle (68 percent), 20 used a boat, and 3 used a horse or dog team to get to the hunting grounds. Only one successful hunter was reported to be a resident of the unit, while 244 (77 percent) were other Alaska residents, 69 (22 percent) were non-residents, and the other three hunters' residency status was unknown. Average hunter effort for unit 26B was 4.85 days (ADF&G, 1996b).

Of the 14 hunters seeking caribou in GMU 26C, nine were successful and harvested eleven caribou from the PCH. Of the successful hunters, seven used an airplane, and one used a snowmachine to access the hunting area. One successful hunter resided in the unit, five were other Alaska residents, and three were non-residents. Average hunter effort for unit 26C was six and a half days (ADF&G, 1996b).

Of all 597 hunters seeking caribou in GMUs 26B and 26C, at least 89 (15 percent) used commercial services, 363 (61 percent) did not, and it is unknown if the remaining 145 hunters employed commercial services in their hunts. Of the successful hunters in those two units, about 23 percent used commercial services to assist the hunt. Five and a half percent of the unsuccessful caribou hunters used commercial services in the 1994-95 year (ADF&G, 1996b).

c. Moose.

In the 1994-95 year, 84 moose were harvested from GMU 26; half of which were taken from Unit 26A, thirty-seven (44 percent) from unit 26B, and six (7 percent) from unit 26C. About half of the 167 hunters seeking moose on the North Slope were successful; of those, fifty-seven (68 percent) used commercial services to assist the hunt. In GMU 26A, 76 percent of the forty-one successful hunters used an airplane to get to the hunting area, while 20 percent used a boat, and the other two used a snowmachine and highway vehicle. Of the 37 successful hunters in unit 26B, 70 percent used an airplane, 22 percent used a boat, and 5 percent used a highway vehicle. Interestingly, 42 percent of the fifty hunters who did not get a moose in unit 26B, made their attempt with a highway vehicle indicating the limitations of road access sport hunting in the area. Five of the six hunters who got a moose in unit 26C, did so with the use of an airplane, the other used a snowmachine (ADF&G, 1996b).

d. Wolf.

Of the 69 wolves harvested from GMU 26 in the 1994-95 year, 46 were taken from unit 26A, eighteen from 26B, and five from 26C. In Unit 26A, 76 percent of the 46 successful hunters used a snowmachine to access the hunting area, 22 percent used an airplane, and one walked. In Unit 26B, six out of 18 successful hunters used an airplane, one used a boat, one used a snowmachine, one walked, and the mode of transportation for the other was not known (ADF&G, 1996b).

e. Other Animals.

In the 1994-95 year, no muskox were harvested in Unit 26A; two Tier II subsistence permits were issued to residents of Unit 26B, but none were harvested; and seven muskox were harvested by snowmachine by residents of Unit 26C (Kaktovik) under federal subsistence rules. Two-thirds of the 24 wolverines taken west of the Canning River drainage, and the remainder from 26B. Half of wolverine harvesters used a snowmachine, 21 percent used an airplane, and 13 percent used a highway vehicle to reach hunting or trapping grounds (ADF&G, 1996b).

The level of sport hunting of waterfowl on the North Slope is currently very low. This is likely due to the number of hunters seeking them, rather than other factors, such as low population levels, climatic

conditions affecting migration, or regulatory constraints. The estimated number of hunter-days afield (number of active waterfowl hunters multiplied by the number of days spent in the field) was 17 for the 1994-95 year; down from 157 hunter-days in the previous year. ADF&G reports that "there are fewer Alaskans hunting waterfowl than any time since the surge in the state's population during the 1970s." (ADF&G, 1996b:59)

3. Tourism and Recreation

According to a 1993 survey conducted by the state Division of Tourism & Trade, 35,400 Alaska visitors traveled the Trans-Alaska Pipeline haul road (Dalton Highway), 17,700 visitors toured the Prudhoe Bay oil fields, and 3,000 visitors saw Barrow, the northernmost point in North America (ADCED, 1993:57). Anaktuvuk Pass, hosts about 1,500 tourists each year, and is the only community in the borough other than Barrow that sees a substantial number of tourists (NSB, 1993:65).

Recreational uses of the Sale 87 area include hiking, skiing, flight-seeing, boating or rafting. Each of these activities has its associated costs, which can be very high in the Arctic. Considering the remoteness and isolation of the sale area, all recreationists must use some kind of commercial outfitter to access the area, and nearly all must fly in. Most outfitters are based out of Fairbanks. In summer, visitors come to the region to camp, hike, float down the Canning River in a river raft, or watch and film whales, birds or caribou.

After October, there are virtually no non-resident recreationists in the sale area. Winter recreation for residents usually occurs near villages. The most favorable months for winter activities such as snow machining and dog sledding are mid-March to early May, when temperatures are higher and daylight hours longer (NSBCMP, 1984a:3-29). The colder and darker months of winter are ideal for social gatherings and craftmaking.

4. Oil and Gas Extraction

Several oil and gas fields are in production or are being developed in or adjacent to the sale area including Endicott, Niakuk, Lisburne, West Beach, North Prudhoe Bay, Pt. McIntyre, and Milne Pt. Plans are underway to develop untapped fields including the Alpine, Northstar, Badami, and Pt. Thompson prospects (see Chapter Two, Exploration History). Four shipping and production structures exist on the Beaufort coast at Olitok Point, West Dock, Heald Point, and Endicott. A dock has also been proposed to facilitate the development of reserves east of the Sagavanirktok River delta. Pipelines have been proposed to connect Colville Delta area production with existing Kuparuk River infrastructure, and Mikkelsen Bay area production with existing Prudhoe Bay, Endicott or Lisburne infrastructure. All proposals involve transporting future production via the Trans-Alaska Pipeline.

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Chapter Five: Reasonably Foreseeable Effects of Sale 87

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Chapter Five: Reasonably Foreseeable Effects of Sale 87

This chapter and the one following it describe the ways in which lease activity resulting from Sale 87 may change the environment and affect its people. The key to understanding the potential for effects lies in understanding the culture, communities, and economy of the North Slope Borough (Chapter Four). Equally important is knowledge of the surrounding natural environment (Chapters Two & Three).

Section A of this chapter describes current methods of oil and gas exploration, development and production in the Arctic. Transportation and accidental discharge of oil and gas are specific issues described in Chapter Six. Section B analyzes effects of oil and gas activities on historic resources, subsistence uses, and fish and wildlife populations of the Sale 87 area. Sections C and D discuss the reasonably foreseeable effects on municipalities and communities, and fiscal effects of this sale. This chapter combines current knowledge of oil field development impacts in the Arctic with the past, present, and reasonably foreseeable future effects of oil and gas lease Sale 87.

Potential bidders begin the process by weighing the costs and benefits of obtaining and keeping the lease. They acquire and analyze existing data, conduct geophysical exploration, estimate the volume and type of recoverable reserves, estimate the cost of developing reserves, and attempt to calculate the expected return on their investment. These considerations may be weighed in light of other factors, such as the state's current leasing policy, schedule of future sales, or competing projects, such as developing prospects overseas. Considering all these variables, it is impossible to predict which tracts will be bid upon and leased.

Strategies used to explore for, develop, produce, and transport potential petroleum resources will vary, depending on factors unique to the individual tract, lessee, operator, or discovery. If a commercially developable deposit is found, any development would require construction of one or more drillsites. If mineral resources can be developed, construction of pipelines would be likely, and other production and transportation facilities would also be necessary. Some new roads may be required, and machinery, labor, and housing would be transported to project sites.

The state of Alaska as a whole, the NSB, and the communities of Nuiqsut, Kaktovik, Anaktuvuk Pass, and Barrow may experience effects of activities following this sale in both monetary and non-cash terms. Impacts to the North Slope region may be minuscule. However, local impacts might be significant. Potential effects include:

- Erosion
- Use conflicts
- Disturbance to wildlife
- Oil spills
- Alteration of hydrology
- Loss of fish and wildlife
- Increased noise and traffic
- Habitat loss or change
- Environmental studies
- Water quality changes
- Chemical/pollutant releases
- Impacts to human environment
- Air quality degradation
- Siltation
- Employment opportunities
- Road, dock, airstrip, sanitary & utilities construction
- State petroleum tax & royalty revenues
- Local oil and gas property tax revenues

Most adverse effects would be temporary and may occur during development, and not during exploration and production phases. Positive effects occur at all phases and fiscal benefits of petroleum extraction may last several decades. All lease-related activities are subject to applicable local, state, and federal statutes, regulations, and ordinances, and subject to lease mitigation measures. Implementation of any exploration and development program must meet the requirements of regulatory agencies prior to approval. Permit requirements must be evaluated in light of the particular activity proposed, and plans of operation must be approved with appropriate project-specific and site-specific safeguards.

DO&G has developed general mitigation measures to minimize pollution and habitat degradation, and disturbance to fish and wildlife species, subsistence uses, and local residents. Additional project-specific and

site-specific mitigation measures will be applied to particular exploration and development proposals as additional information becomes available. Despite these protective measures, some impacts may occur. In this chapter, potential impacts are discussed, and measures to mitigate future impacts are summarized. For a full text listing of Sale 87 mitigation measures see Chapter Seven.

A. Post Lease Sale Phases

Lease-related activities proceed in phases; each subsequent phase's activities depend on the completion or initiation of the preceding phase. Table 5.1 lists activities that may occur during these phases.

Table 5.1 Activities That May Be Found At Post Lease Sale Phases

Exploration	water usage permitting environmental studies seismology exploratory drilling rigs ice roads & ice pads marine vessel support drilling pads gravel pads (tail) worker camps increased air traffic
Development	permitting environmental studies research and analysis gravel pits, pads and roads dock, bridge, and facility construction buried & elevated pipelines drilling rigs work camps increased air and vessel traffic air emissions
Production	permitting monitoring well workovers injection wells, gas and sea water gravel pads and roads produced water injection air emissions pipeline maintenance work camps support infrastructure

1. Exploration

The purpose of exploration is to gather as much information about the petroleum potential of an area as possible. Some activities take place before the lease sale as prospective bidders evaluate the offered acreage; however most extensive exploration operations occur after the lease sale.

Exploration activities may include the following: research and monitoring, examination of the surface geology, geophysical survey programs, researching data from existing wells, performing environmental assessments, and the drilling of an exploratory well. 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

- Permittees shall consult the Alaska Heritage Resources Survey so that known historic and archaeological sites may be avoided.

- The permittee remains responsible for obtaining the approval of other surface or subsurface interest holders, individuals, companies, and agencies as may also be required. For example, operations within or crossing the Trans-Alaska Pipeline corridor require prior authorization from Alyeska.
- The provisions of the federal and state Endangered Species Acts and the federal Marine Mammal Protection Act must be adhered to at all times. The Endangered Species Act provides that there will be no activity permitted that jeopardizes the continued existence of an endangered species or results in the destruction or adverse modification of habitat of such species. The applicant is advised to contact the Anchorage U.S. Fish and Wildlife Service, Endangered Species Office for additional information on endangered species.
- The use of ground contact vehicles for off-road travel is subject to regional openings and closure notices issued by ADNR. Operations are restricted to the winter seasonal opening. After April 15, the use of ground contact vehicles is subject to termination within 72 hours of written notification from ADNR.
- Vehicles shall be operated in a manner such that the vegetative mat is not disturbed, and blading or removal of vegetative cover is prohibited except as approved by ADNR. Filling of low spots and smoothing using snow and ice is allowed.
- Movement of equipment through willow (*Salix*) stands must be avoided wherever possible.
- Equipment, other than vessels, must not enter open water areas of a watercourse during winter. Ice or snow bridges and approach ramps constructed at river, slough, or stream crossings must be substantially free of extraneous material (i.e., soil, rock, wood, or vegetation) and must be removed or breached before spring breakup. Alterations of the banks of a watercourse are prohibited.
- Secondary containment shall be provided for fuel or hazardous substances. Rules apply to the use of container marking, surface liners, and the storage, handling and transfer of fuel.
- Oil spills must be reported immediately. All fires and explosions must also be reported.
- Trails, campsites and work areas must be kept clean. Trash, survey lath markers, and other debris that accumulates in camps, along seismic lines, and travel routes, that is not recovered during the initial cleanup, shall be picked up and properly disposed of prior to freeze-up the following winter. All solid wastes, including incinerator residue, shall be backhauled to a solid waste disposal site approved by ADEC.
- Operations must avoid occupied grizzly bear dens by one-half mile unless alternative mitigative measures to minimize disturbance are authorized by ADNR after consultation with ADF&G. Known den locations shall be obtained from ADF&G prior to starting operations. Occupied dens encountered in the field must be reported to the above, and subsequently avoided.
- Operations must avoid known polar bear dens by one mile. Known den locations shall be obtained from the U.S. Fish and Wildlife Service prior to starting operations. New dens encountered in the field must be reported to the above, and subsequently avoided by one mile.

Vehicle maintenance, campsites and/or storage and stockpiling of material on surface ice of lakes, ponds, or rivers is prohibited. To avoid additional freeze-down of deep-water pools harboring overwintering fish, watercourses shall be crossed at shallow riffle areas from point bar to point bar. Compaction or removal of the insulating snow cover from the deep-water pool areas of rivers must be avoided. Geophysical exploration of the Sale 87 area has been ongoing for several decades. Usually, geophysical companies conduct seismic surveys under contract with lease holders. Contracts may have provisions that allow the geophysical company to sell the data to other interested companies. Geophysical programs may take place before or after a lease sale. If sufficient data are already available, additional seismic data acquisition may not be necessary. Lessees may or may not propose operations which include seismic surveys in the Sale 87 lease area.

Geophysical exploration activities are regulated by 11 AAC 96 and permits are tailored specifically for each project. Restrictions on geophysical exploration permits depend on the duration, location and intensity of the project. They also depend on the potential effects the activity may have on important habitat and species, such as caribou and waterbirds. The extent of effects on important species varies depending on the survey method and the time of year the operation is conducted. Geophysical surveys help reveal what the subsurface looks like and help locate subsurface hazards.

The geophysical survey process involves sending energy into the earth or using an energy wave generating method, such as Vibroseis. Vibroseis generates waves of continuously varying frequency. The energy waves bounce back from the various rock layers and are received and changed into electrical impulses by listening devices called geophones. The impulses are recorded on computer tape, processed on high speed computers, and displayed in the form of a seismic reflection profile. Geophysicists then analyze the profile to

determine subsurface features. Other sources of energy include explosive charges, however this method has largely given way to the Vibroseis method, and their use on the North Slope is rare.

Vibroseis components are usually mounted on trucks with large tires or tracked vehicles. Snow plows may be required in advance of these source units when snow is deep. Supply vehicles for crews may include 6-wheel drive articulating buggies with a 2,500 gallon fuel tank mounted on them and a crane for moving heavy parcels. These supply crews with fuel, water, groceries, parts, and personnel. Between 2 and 5 supply units may be used for each seismic survey depending on the size of the survey, whether it is 2-D or 3-D, and depending on the distance from a fuel source. Camps consist of strings of trailers hooked together and pulled where necessary by Caterpillar tractors. Each camp is equipped with generators, a kitchen, diner, wash house, recreation room, crew office, survey office, mechanic's shop, geophone and cable repair shop, dry stores, part house, and sleeping quarters. Camps also may include one or more fuel sleds, an incinerator, a snow melter for making water, and a steamer unit. Camps can house approximately 60 persons at a time for a 2-D survey, and 100 persons for a 3-D survey. Camps use between 2,800 to 3,300 gallons of fuel per day and 2,000 to 3,000 gallons of water per day (Rice, 1997).

Standard permit conditions for North Slope seismic operations are designed to protect resource values and ensure compliance with the Alaska Coastal Management Program.

- All aircraft shall maintain an altitude of 1,500 feet or a lateral distance of one mile, excluding takeoffs and landings, from caribou and muskoxen concentrations.

b. Exploration Drilling

Exploratory drilling only occurs after seismic surveys are conducted which may reveal petroleum potential. If geophysical exploration studies indicate the possibility that oil or gas may be present, lessees may initiate the drilling of an exploration well. The only way to learn whether or not commercial quantities of oil or gas are present in the rock formations beneath a lease is by drilling. Exploratory drilling happens after the lease sale (after mineral rights have been secured) and after preliminary exploration activities reveal the most likely places to find oil or gas. Occasionally in unexplored areas, companies have joined together to drill a stratigraphic test well (a test which merely determines subsurface layers) prior to the lease sale in order to gather information. However, this is rarely, if ever, done these days. Companies usually gather as much information as they can using less expensive methods and secure the lease before drilling an exploratory well.

Onshore exploratory drilling operations on the North Slope almost always occur in winter to minimize impact and reduce costs. Temporary roads are constructed of ice by adding water to the surface which freezes into a form that can support heavy loads. Mitigation Measure 6 states that exploration facilities, must be temporary and must be constructed of ice unless the Director determines that no feasible and prudent alternative exists. In extraordinary circumstances, permanent roads made of sand and gravel may be permitted. A drill site is selected to provide access to the prospect to be drilled and is located to minimize impacts to any sensitive areas, such as private property or an archaeological site. The ice pad supports the drill rig assembled at the site, a fuel storage area, and a camp for 50 to 60 workers. Ice pads are approximately 500 feet by 500 feet. If the facilities are not available, a temporary camp of trailers on skids or wheels can be placed on the pad. Ice road and pad construction begins during middle to late December when ambient temperatures are cold enough for relatively fast construction (Hazen, 1997). Potential impacts of ice pads on tundra are discussed in Section B.

Exploratory drilling generates information for the lessee which will aid in the decision whether to proceed to the development phase. Drilling operations collect core samples, well logs, cuttings, and various test results. Cores may be cut at various intervals so that geologists and engineers can examine the sequences of rock that are being drilled. Well logs are records of tests conducted by lowering various instruments into the well bore.

If the exploratory well is successful, the operator will probably drill one or two more wells to delineate the extent of the discovery and gather more information about the field. The lessee needs to know how much oil and gas may be present, and must determine the quality of the rocks in which they are found to determine whether or not to proceed to the next phase. The extent and location of offshore exploratory and delineation drilling depends on petroleum potential (BPX, 1996).

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 the rock formations below the surface and into the lease.
3. Blowout preventers are installed on the surface and only removed when the well is plugged and abandoned. Blowout preventers are large, high-strength valves which close hydraulically on the drill pipe to prevent the escape of fluids to the surface. (ARCO, Undated: 80-84)
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, seal the well bore from groundwater, and to provide a conduit from the bottom of the hole to the drilling rig.

An exploratory drilling operation generates approximately 12,000 cubic feet of drilling solids. Cuttings are fragments of rock cut by the drill bit. These fragments are carried up from the drill bit by the mud pumped into the well (Gerding, 1986: 97-174). Also produced from drilling operations are gas, formation water, and fluids and additives used in the drilling process. The fluids pumped down the well are called mud, and different formulations are used to meet the various conditions encountered in the well. Muds are naturally occurring clays and small amounts of biologically inert products. They cool and lubricate the drill bit, prevent the drill pipe from sticking to the sides of the hole, seal off cracks in down-hole formations to prevent the flow of drilling fluids into those formations, and carry cuttings to the surface (ARCO, Undated: 80-84).

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 20 AAC 25.080. 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 discovers oil, it is likely that the pad used for the exploratory well will also be used for production testing operations.

Mitigation measure 17b regulates the disposal of muds and cuttings. The preferred method for disposal of muds and cuttings from oil and gas activities is by underground injection. Injection of non-hazardous oil field wastes generated during development is regulated by AOGCC through its Underground Injection Control (UIC) Program for oil and gas wells. Annular disposal of muds and cuttings associated with drilling an exploratory well is permitted by ADEC. Surface discharge of drilling muds and cuttings into lakes, streams, rivers, and high value wetlands is prohibited. Surface discharge of drilling muds and cuttings into reserve pits shall be allowed only when the Director, in consultation with ADEC, determines that alternative disposal methods are not feasible and prudent. If use of a reserve pit is 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. Onpad temporary cuttings storage will be allowed as necessary to facilitate annular injection and/or backhaul operations.

Mitigation measure 18 regulates the disposal of produced water and other wastewater. Disposal of produced waters in upland areas, including wetlands, will be by subsurface disposal techniques. ADEC may permit alternate disposal methods if the lessee demonstrates that subsurface disposal is not feasible or prudent. Surface discharge of reserve pit fluids will be prohibited unless authorized by ADEC permit and approved by DL.

2. Development and Production

The development and production phases are interrelated and overlap in time; therefore, this section discusses them together. During the development phase, operators evaluate the results of exploratory drilling and develop plans to bring the discovery into production. Production operations bring well fluids to the surface and prepare them 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: 177-199)

After designing the facilities, the operator constructs permanent structures and drill production wells (See Figure 5.1). 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. Gravel pads are semi-permanent structures used for production facilities and can be rehabilitated following field depletion.

The development "footprint" in terms of habitat loss or gravel filling has decreased in recent years as advances in drilling technology have led to smaller, more consolidated pad sizes. A single production pad and several directionally drilled wells can develop more than one and possibly several 640 acre sections. Unless pool rules (oil or gas field rules governing well drilling, casing, and spacing which are designed to maximize recovery and minimize waste) have been adopted under 20 AAC 25.520, existing spacing rules stipulate that where oil has been discovered, not more than one well may be drilled to that pool on any governmental quarter section (20 AAC 25.055(a)). This would theoretically allow a maximum of four well sites per 640 acre section. Where gas has been discovered, not more than one well per section may be drilled into the pool. (See Figure 5.2)

Production facilities will likely include several production wells, water injectors, gas injection wells, and a waste disposal well. Wellhead spacing may be as little as 10 feet. A separation facility would remove water and gas from the produced crude, and pipelines would carry the crude to the Trans-Alaska Pipeline System (TAPS). Some of the natural gas produced is used to power equipment on the facility but most is re-injected to maintain reservoir pressure. Produced water is also reinjected. Often, sea water is treated and injected into the reservoir in order to maintain pressure, improve recovery, and replace produced fluids. Produced water is treated to remove sand and other particles. Sea water is filtered to remove solids and dissolved oxygen.

Figure 5.1 Typical Projection/Injection Well

B. Cumulative Effects

AS 38.05.035(g) requires DNR to consider and discuss the reasonably foreseeable cumulative effects of oil and gas exploration, development, production, and transportation on the sale area, including effects on subsistence uses, fish and wildlife habitat and populations and their uses, and historic and cultural resources. However, DNR is not required to speculate about possible future effects subject to future permitting that cannot reasonably be determined until a project or proposed use for which a written best interest finding is required is more specifically defined. AS 38.05.035(h).

Accordingly, in the section, DNR sets out relevant and important information which is currently known to DNR about the lease sale 87 area, and considers and discusses the reasonably foreseeable effects of additional activities which may result from Sale 87 related oil and gas exploration, development, production and transportation. By necessity, some of this discussion is general in nature. While certain activities are reasonably foreseeable because they would be components of any oil and gas activity on the North Slope, activities specific to certain areas or tracts are not reasonably foreseeable because the odds of finding and developing commercially exploitable quantities of oil or gas from any particular tract are slim.

Therefore, DNR will require numerous general mitigation measures which will be applicable to any Sale 87 activity, no matter where in the sale area. These mitigation measures provide a floor of protection, to be enhanced by more specific mitigation measures as required by any particular plan of operation which may eventually be proposed.

1. Effects on Water and Air Quality, and Land Habitat

a. Effects on Water Quality

Water quality throughout the sale area varies seasonally with changes associated with streamflow. Mean annual peak runoff occurs from late May to early July during and after break-up and elevated turbidity and suspended sediment levels are common during these months. Natural as well as man-made contaminants can result in exceedences of water quality criteria. Natural contaminants to fresh water supplies include dead fish, birds, and animals; mosquito and insect larvae; algae and other plants; bacteria; parasites such as Giardia; silt and glacial flour; arsenic, iron, manganese; and hydrogen sulfide gas (AEIDC, 1975).

Water quality characteristics which may be altered by post-sale activities include pH, total suspended solids, organic matter, calcium, magnesium, sodium, iron, nitrates, chlorine, and fluoride. Potential impacts which may alter surface water quality parameters of the sale area include accidental spills of fuel, lubricants or chemicals; increases in erosion and sedimentation causing elevated turbidity and suspended solids concentrations; and oil spills (Parametrix, 1996).

Geophysical exploration of the sale area with tracked seismic vehicles is not expected to alter water quality because seismic surveys are conducted in winter and permit conditions mitigate potential damage. Under standard DNR permit conditions for winter seismic exploration on the North Slope, 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 ground surface. Operations are restricted to the winter seasonal opening. Equipment, other than vessels must not enter open water areas of a watercourse during winter, and any ice roads, ice bridges, or approach ramps constructed near river, slough, or stream crossings must be free of extraneous material before break-up. Alterations of the banks of a watercourse are prohibited (ADGC, 1995). Adherence to these conditions thus avoids or minimizes post-seismic increases in erosion, turbidity, and suspended solids in a drainage area.

The extent and duration of water quality degradation resulting from accidental spills depends on the type of product; the location of the spill; volume; season and 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, such as during refueling, or from corrosion of lines (Parametrix, 1996). Under standard ADNR permit conditions for off-road activity, fuel and hazardous substances must have secondary containment apparatus. A secondary containment or surface liner must be placed under all container or vehicle

fuel tank inlet and outlet points. Appropriate spill response equipment must be on hand during any transfer or handling of fuel or hazardous substances. Vehicle refueling is prohibited within the annual floodplain or tidelands (ADGC, 1995). Impacts of oil spills are discussed in Chapter Six.

Other standard DNR land use permit conditions serve to protect water quality values from facility construction and operation. Trails, campsites and work areas must be kept clean. Trash, survey markers, and other debris that may accumulate in camps or along seismic lines and travel routes that are not recovered during the initial cleanup must be picked up and properly disposed of. All solid wastes, including incinerator residue must be backhauled to a solid waste disposal site approved by ADEC. Vehicle maintenance, campsites, and the storage or stockpiling of material on the surface of lakes, ponds, or rivers are prohibited (ADGC, 1995).

The federal Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) to permit discharges of pollutants into U.S. waters by "point sources," such as industrial and municipal facilities. In Alaska, the U.S. Environmental Protection Agency issues NPDES permits, designed to maximize treatment and minimize harmful effects of discharges as water quality and technology improvements are made. ADEC certifies that these discharge permits will not violate the state's water quality standards.

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

Mitigation Measures.

Several Sale 87 mitigation measures and lessee advisories serve to protect water quality from post-sale oil and gas activities. The following are summaries of some applicable mitigation measures. For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to water quality are:

- Tundra protection -- Winter and summer off-road vehicular traffic is restricted and must be approved in plan of operations.
- Wetland and Riparian Protection -- Lessees must avoid siting facilities in key wetlands and identified sensitive habitat areas. Onshore facilities other docks, or road and pipeline crossings, will not be sited within 500 feet of fishbearing streams. Permanent facility siting is prohibited within one-half mile of the banks of major rivers.
- Water Conservation -- Removal of water from fishbearing rivers, streams, and natural lakes shall be subject to prior written approval by DMWM and ADF&G.
- Turbidity Reduction -- Exploration facilities, with the exception of artificial gravel islands, must be temporary and must be constructed of ice. Gravel mining sites will be restricted to the minimum necessary to develop the field efficiently and with minimal environmental damage and must not be located within an active floodplain of a watercourse. Causeways and docks may not be located in river mouths or deltas.
- Drilling Waste -- Underground injection of drilling muds and cuttings is preferred method of disposal. For onshore development, produced waters must be injected. Surface discharge of drilling wastes into waterbodies and wetlands is prohibited. Discharge of produced waters in marine waters less than 10 m deep is prohibited. Unless authorized by NPDES or state permit, disposal of wastewater into freshwater bodies, including Class III, IV, VI, and VIII wetlands, is prohibited.
- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, and cleanup of oil spills. Pipelines must be designed and located to facilitate clean-up. Buffer zones of not less than 500 feet will be required to separate onshore oil storage facilities (with a capacity greater than 660 gallons) and sewage ponds from freshwater supplies, streams, and lakes and key wetlands

b. Effects on Air Quality

Air quality throughout the sale area is very good, with concentrations of regulated pollutants well below the maximum allowed under National Ambient Air Quality Standards designed to protect human health. In order to ensure that air quality standards are maintained, additional limitations on nitrogen dioxide, sulfur dioxide, and total-suspended-particulate matter are imposed on industrial sources under the provisions of the Prevention of Significant Deterioration Program, administered by EPA.

Routine activities associated with oil and gas exploration, development and production that are likely to affect air quality are emissions from construction, drilling and production. Air pollutants include nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO₂), particulate matter (PM), and volatile organic compounds¹ (VOC) (MMS, 1995, IV.B.1-92). Effects from VOC emissions would be insignificant because of the low potential for ozone formation. Photochemical pollutants such as ozone (O₃) form in the air from the interaction of pollutants in the presence of sunshine and heat. In the upper atmosphere ozone is beneficial because it absorbs solar ultraviolet radiation. In the lower atmosphere however, it is a strong oxidizing agent and can be harmful. There is a low potential for ozone formation in the sale area because the summer time air temperatures remain relatively low (MMS, 1996a, IV.B.1-94).

Emissions, such as engine exhaust and dust would be produced by trucks, heavy construction equipment and earth moving equipment. Emissions would be generated during installation of pipelines and utility lines, excavation and transportation of gravel, mobilization and demobilization of drill rigs, and during construction of gravel pads, roads, and support facilities. Elevated levels of airborne emissions would be temporary and would diminish after construction phases are complete. Emissions would also be produced by engines or turbines used to provide power for drilling, oil pumping, and water injection. In addition, aircraft, supply boats, personnel carriers, rollogon trucks, mobile support modules, as well as intermittent operations such as mud degassing and well testing would produce emissions (MMS, 1996a, IV.B.1-93).

During tanker loading operations at the Valdez terminal, emissions would result from the tanker-exhaust stacks and fugitive losses. To operate oil storage and transfer facilities, the operators would be required to provide air quality analysis and to obtain permits which meet state and federal ambient air quality standards.

Other sources of air pollution include evaporative losses (VOC) from oil/water separators, pump and compressor seals, valves and storage tanks. Venting and flaring could be an intermittent source of VOC and SO₂ (MMS, 1995, IV.B.1-93). Gas blowouts, evaporation of spilled oil and burning of spilled oil may also affect air quality. Gas or oil blowouts may catch fire. A light, short-term coating of soot over a localized area could result from oil fires. However, soot produced from burning oil spills tends to slump and wash off vegetation in subsequent rains, limiting any health effects (MMS, 1995, IV.B.1-95).

Several kinds of atmospheric pollutants can be found in the Arctic including organic contaminants and pollutants associated with the burning of fossil fuels, smelting, and industry. There is increasing concern about these contaminants entering the Arctic food chain; a concern that researchers have been aware of since the 1970's. Most contaminants do not originate in the Arctic, but likely result from long-range transport from lower latitudes. The U.S. EPA has initiated a regional study to collect data on atmospheric contaminants which would complement other circumpolar nations' research efforts. Although there are published data on food chain contamination by DDT and radionuclides, there are little if any data on U.S. Arctic food web contamination from other sources (MMS, 1991).

Arctic haze is a generic term for pollutant-laden aerosols distributed throughout the polar regions in late winter and early spring. Arctic haze probably develops from both man-made contaminants reaching the Arctic from the south, and from pollutants originating from the industrialized Arctic. In late spring, these materials may be deposited on snow covered land masses. Brown snow events occur intermittently in the Arctic and are believed to be caused by industrial emissions from Asia (MMS, 1991). Despite the seasonal long-distance transport of contaminants into the Arctic, pollutant levels in the air above the sale area are still far below maximum allowable standards (MMS, 1996b:III-A-14).

¹ Volatile organic compounds are any hydrocarbon that can become a vapor at room temperature.

It is not possible to predict at the lease sale stage the amount of pollutants produced. All industrial emissions in the Arctic U.S. must comply with the Clean Air Act (42 U.S.C. §§ 7401-7642) and state air quality standards. 18 AAC 50 provides for air quality control including permit requirements, permit review criteria, and regulation compliance criteria. 18 AAC 50.300 sets up standards for air quality at certain facilities, including oil and gas facilities, at the time of construction, operation, or modification. DO&G continues to search for, but has not found any evidence that fish or terrestrial mammal population declines are linked to industrial emissions emanating from existing north slope oil and gas facilities. Federal and state statutes and regulations that will mitigate potential impacts air quality included:

- 42 U.S.C. §§ 7401-7642. Federal Clean Air Act
- AS 46.03. Provides for environmental conservation including water and air pollution control, 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. Sets up standards for air quality at certain facilities including oil and gas facilities at the time of construction, operation, or modification.

ADEC's Air Quality Maintenance program controls significant, stationary sources of air contaminants to protect and enhance air quality and abate impacts on public health and the environment. The 1970 Clean Air Act established air quality programs to regulate air emissions from stationary, mobile and other sources which pose a risk to human health and the environment. ADEC monitors compliance with regulations and air quality standards through annual inspections and uniform enforcement procedures. The agency issues operating permits to existing major facilities incorporating all applicable requirements, and issues construction permits to new large facilities and for expansions of existing facilities.

c. Effects on Land Habitat

Seismic surveys: Winter seismic surveys affect tundra vegetation depending on snow depth, vehicle type, traffic pattern, and vegetation type. Camp move trails disturb vegetation more than seismic trails. Multiple vehicles in a single narrow trail cause more disturbance than dispersed tracks. Trails in shrub-dominated tundra recover slower than other vegetation types (Jorgenson and Martin, 1997).

Winter seismic trails can compress microtopography resulting in a wetter microenvironment and decreased vegetation cover of upright shrubs (willows), lichens, and mosses. Winter seismic trails have little adverse effect on (and may possibly enhance growth of) *C. aquatalis* and *E. angustifolium* due to the resulting wetter microenvironment (Noel & Pollard, 1996, citing to Felix & Reynolds, 1989). Effects can be substantial if operations are conducted improperly. Vehicles can leave visible tracks in the tundra which should disappear and vegetation should recover within a few years. Vehicles using tight turning radii have sheared off upper layers of vegetation, but left rhizomes intact, and plants should recover. Dry snowless ridges and vegetated sand dunes are at higher risk of damage. Damage to vegetation can be avoided by limiting travel to areas with at least 6 inches of snow cover, and avoiding minimum radius turns. In areas where damage is extensive, and natural recovery not expected, restoration may be required of operators (Schultz, 1996).

A study of the impact of a 1984-1985 seismic exploration program in ANWR indicated that recovery was not complete a decade after disturbance. Trails in sedge-dominated tundra recovered well, unless initial disturbance was high. Impacts on medium and highly disturbed trails may persist for a decade or more. Such impacts include increased thaw depths, trail subsidence, shifts to wetter conditions, ruts, invasion of grasses, and decreases in shrub cover (Jorgenson and Martin, 1997).

Drilling and Production Discharges: During exploration well drilling, muds and cuttings are stored on-pad, in holding tanks, or in a temporary reserve pit, and then hauled to an approved solid waste disposal site or reinjected into the subsurface at an approved injection well. All production muds and cuttings on the North Slope are reinjected into a Class II injection well. All produced waters are reinjected either into the producing formation to enhance recovery, or into an injection well. The Underground Injection Control program is administered by AOGCC. Drilling and production discharges are expected to have no impact on tundra habitat.

Effects of Construction and Gravel Infilling: Effects of constructing production pads, roads, and pipelines include direct loss of acreage due to gravel infilling, and loss of dry tundra habitat due to entrainment

and diversion of water. A secondary effect of construction activities includes dust deposition, which may reduce photosynthesis and plant growth. Construction activity involving vehicular passage (see above, Effects of Seismic), such as a rollogon, may upset the thermal balance of the permafrost beneath the tundra, especially in non-winter months. Road construction, vehicular passage, and oil spills can alter surface albedo (reflectivity of sunlight off the earth's surface) or water drainage patterns, resulting in thaw and subsidence or inundation. Such changes can affect regeneration and revegetation of certain species, and specie composition may also change after disturbance from construction activities (Linkins, et al., 1984).

After an oil field is abandoned, some level of land rehabilitation will be required to restore areas impacted by oil and gas activities. Recovery of wetlands disturbed by gravel infilling varies depending on soil moisture content and amount of available soil organic matter (Kidd, et al., 1997, citing to Jorgenson and Joyce, 1994). Removal of gravel from pads and roads is the initial step in rehabilitation. At sites on the North Slope where gravel fill has been removed, problems have emerged associated with ponding, thaw subsidence, and nutrient cycling. One method preferred by ADF&G is to remove all gravel and create pond habitat that resembles pre-construction conditions. In some cases, full gravel removal may not be the optimum recovery option. In most cases, plant cultivation is desirable with the use of plant species identified as important for waterbird habitat. While rehabilitation methods for gravel pad and roads vary depending on site-specific conditions, the overall goal of rehabilitation in the existing oil fields is to create a mosaic of moist meadows, sedge meadows, and grass marshes. Several plant cultivation treatments have been used on the North Slope including fertilizer only, native-grass cultivation, *Arctophila* transplantation, and sedge-plug transplantation. Optimum recovery of the tundra marsh would include reestablishing vegetation, soil microbiotic, phytoplankton, aquatic invertebrate, and wildlife communities at the impacted site (Kidd, et al., 1997).

Ice roads and Pads: Ice roads and pads cause depressions in microtopography due to compaction. The thaw depth in summer increases beneath the impacted area after melt and there is an increase in wetness due to compression. Ice roads compress and shear tussocks, which may take up to four years or more to recover. Some tussocks remain dead and damaged from ice road effects for years (Noel and Pollard, 1996, citing to Walker, et al., 1987). Ice roads and pads also affect tundra regeneration, with certain species recovering faster after summer melt than others. Most vegetation should recover within three seasons following melt. Ice road thaw depths return to pre-impact levels after several years (Noel and Pollard, 1996).

Single season ice roads melt in spring and leave little if any trace. Multi-season ice pads can result in limited short-term impact, if tundra around the perimeter of the pad thaws and is blocked from sunlight. Insulated paneling held down by fabric and timbers at the perimeter of a multi-season pad can result in sun-blockage and impeded growth. Modifications to pad design are currently being tested on the North Slope to minimize impacts to the tundra surface (Hazen, 1997).

Gas Blowouts: If a natural gas blowout occurred, plants in the immediate vicinity may be destroyed. Natural gas and condensates that did not burn in the blowout would be hazardous to any organisms exposed to high concentrations. Insects, such as mosquitoes would also be affected or killed by a gas blow-out. A plume of natural gas vapors and condensates would be dispersed very rapidly from the blowout site, but is not expected to be hazardous for more than one kilometer downwind or for more than one day. Natural gas development is expected to have little to no effect on lower trophic-level organisms (MMS, 1996b: IV-L-2).

Oil Spills: Spilled oil will affect tundra depending on time of year, vegetation, and terrain. Oil spilled on the tundra will migrate both horizontally and vertically. This flow depends on factors including 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 is exposed to chemical weathering. If the ground temperature is less than the pour point of the oil, it will pool and be easier to contain. Absorption of the oil by the tundra itself will also limit flow and reduce the area contaminated. Experiments in Canada by MacKay, et al. (1974) revealed that mosses have high absorption capacity. Moss covered tundra can absorb more than 13 gallons of oil per square meter, compared to less than a gallon for non-moss covered tundra (Linkins, et al., 1984). If there is a vertical crack through different soil horizons, oil will migrate down to the permafrost. If no cracks are present in the soil layers beneath the tundra, oil moves laterally in the organic material, does not penetrate the silty clay loam mineral soils beneath, and oil contamination would be restricted to the top few centimeters of the soil layer. Dry soils have greater porosity and the potential for vertical movement is greater (Linkins, et al., 1984, citing to Everett, 1978). If oil

penetrates the soil layers and remains in the plant root zone, longer term effects, such as mortality or reduced regeneration would occur in following summers.

Fungi are important decomposers of organic material in tundra soil. In experiments near Barrow, Campbell et al. (1973) noted that oil spilled on acid-wet meadow tundra resulted in increased yeast, and decreases in filamentous fungi populations. Large numbers of fungi have been found in association with a natural oil seep at Cape Simpson. Under the right conditions involving oxygen, temperature, moisture in the soil, and the composition of the crude being spilled, bacteria assist in the break-down of hydrocarbons in soils. Petroleum-contaminated soils are commonly treated with fertilization, raking, and tilling (bioremediation). Research is ongoing in the use of microbes to assist the natural break down of petroleum in soils and gravel (Linkins, et al., 1984) (AJC, 1996).

Mitigation Measures.

The following are summaries of some applicable mitigation measures. For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to land habitat organisms are:

- Tundra protection -- Winter and summer off-road vehicular traffic is restricted and must be approved in plan of operations.
- Wetland protection -- Lessees must avoid siting facilities in key wetlands and identified sensitive habitat areas.
- Habitat loss minimization -- Exploration facilities must not be constructed of gravel. Ice roads and pads are preferred structures. Gravel mining is restricted to the minimum necessary to develop the field efficiently.
- Drilling waste -- Underground injection of drilling muds and cuttings is preferred method of disposal. For onshore development, produced waters must be injected. Surface discharge of drilling wastes into waterbodies and wetlands is prohibited. Discharge of produced waters into open or ice-covered marine waters of less than 10 meters in depth is prohibited.
- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, and cleanup of oil spills. Pipelines must be designed and located to facilitate clean-up.
- Rehabilitation -- At the option of the state, all improvements such as roads, pads, and wells must be either abandoned and the sites rehabilitated by the lessee, or left intact. Any machinery, equipment, tools or materials left behind after the lease is terminated become the property of the state, and may be removed by the state at the lessees expense.

2. Effects on Fish and Wildlife Habitats, Populations, and Uses

a. Fish

Anadromous streams within the sale area include the Colville, Sagavanirktok, Shaviovik, and Kadleroshilik Rivers. The Canning River is adjacent to the eastern boundary of the sale area. Numerous other rivers and streams which flow through the sale area also support anadromous fish populations. Several species of anadromous fish spawn and overwinter in these rivers and during summer migrate to nearshore coastal waters of the sale area to feed. Migration patterns vary by species and within species by life stage (see Chapter Three). Potential effects include degradation of stream banks and erosion; reduction of or damage to overwintering areas; habitat loss due to gravel removal, facility siting, and water removal; impediments to migration; and fish kills due to oil spills.

Habitat loss: Potential impacts at all phases include erosion. Erosion results in siltation and sedimentation, which in turn may result in a reduced or altered stream flow that may affect overwintering habitat availability, and affect the ability of fish to migrate upstream. Protecting the integrity of stream bank vegetation and minimizing erosion are important elements in preserving fish habitat. Streambeds could be affected if stream banks are altered, such as damage from equipment crossings. Overwintering habitat may be limited; the Colville River provides the most consistently available overwintering habitat for anadromous fish in the sale area.

Removal of water from lakes where fish are overwintering may affect the viability of overwintering fish, and longer term effects of lake drawdown may impede the ability of fish to return to the lake in subsequent years. Removal of snow from lakes may increase the freeze depth of the ice, kill overwintering and resident fish, and adversely affect the ability of fish to utilize the lake in future years.

During development, unregulated gravel removal from fishbearing streams to support oil and gas activities could adversely impact anadromous fish they support. Gravel removal could increase sediment loads, change the stream bed course, cause instability upstream, destroy spawning habitat, and create obstacles to fish migration. Gravel removal from stream beds could also cause potential damage to overwintering fish populations. Gravel mine sites can be restored as overwintering habitat and thus add to total available fish habitat.

Causeways: Though remote, the possibility of needing a causeway into the nearshore Beaufort Sea to support development in portions of the Sale 87 area does exist, placement of causeways, particularly continuous-fill causeways into the nearshore Beaufort Sea or in river deltas can alter patterns of nearshore sediment transport, alter patterns of water discharge to the nearshore environment, and alter temperature and salinity regimes in areas near the causeway. The extent of alterations depends on the size or length of the causeway, its location relative to nearby islands and river mouths or deltas, and pre-causeway oceanographic characteristics. Minimizing alterations is accomplished by proper siting, minimal size, and by ensuring that breaches are sized and located to maximize goals. Changes to the physical environment may alter patterns of use of the deltaic area by anadromous and marine fishes. Changing marine current flow and circulation patterns result in physical changes to delta channeling and shorelines which could affect use by animals which feed on fish, such as shorebirds and waterfowl (Winters, 1996).

In the case of the West Dock causeway, the structure diverts the nearshore current along the coast, resulting in colder, more saline water entering a lagoon pass area that had been warmer and less saline before construction. Studies revealed that the oceanographic characteristics of this pass area (and lagoons) were important to fish migration. Fish catch data revealed that saltwater-intolerant fish utilize the warmer less saline nearshore zone as they migrate from the Mackenzie River system in Canada. Anadromous fish may also travel from other river deltas, such as the Colville, to feed, utilizing the lagoons shoreward of the barrier islands.

East wind-induced eddies at West Dock, which create a cell of cold, saline water in the normally warm and brackish nearshore zone, may occasionally disrupt the eastward movement of Colville River young least cisco during their summer nearshore feeding migration, but this infrequent occurrence has had no apparent effect on least cisco populations (Fechhelm et al. 1994).

After West Dock was constructed and extended (after a barge became stuck in the ice), there was concern that the structure restricted the ability of fish to avoid cold saline water during their migration. Small Arctic cisco are transported to the Prudhoe Bay area when northeast winds are sufficiently strong and long-lasting to induce longshore movement of water from the Mackenzie River in Canada (Gallaway et al. 1991). The cell of colder saline water between Stump Island and the causeway, created by eddying off the tip of the structure occurs at a key point along the migratory path. These conditions may block eastward movement around the causeway, specifically for smaller fish. Fish whose migration may be disrupted include least cisco, small Arctic cisco, and large broad whitefish. Dolly varden char are stronger swimmers and more tolerant of saline water. Studies indicate that fish movements have not been impacted by either causeway (Gallaway et al., 1991; Colonell & Gallaway, 1990).

Similar concerns were raised about the Endicott causeway. After extensive studies and debate, a negotiated settlement agreement was reached between the Army Corps of Engineers and industry to breach the causeways thereby providing fish access to the lagoonal migratory corridor, and bring both structures in compliance with state water quality standards (USACE, 1991).

Due to the variability in oceanographic characteristics from year to year, a multi-year monitoring program would be necessary to accurately determine pre versus post-construction effects. A multi-year pre-construction baseline sampling program plus a multi-year post-construction program are necessary to document any adverse effects on fish (Winters, 1996). Some causeway designs could enhance marine productivity and facilitate propagation of fish species. Several years of oceanography studies and fish sampling have been conducted in Mikkelsen Bay, where a causeway or dock has been planned for the Badami

Development Project. No other causeway-type gravel structures are currently for developing nearshore Beaufort reserves.

Despite extensive research into their effects, evidence that the two causeways have had significant population level impacts on anadromous fish remains inconclusive. Some analysts are convinced that impacts of causeways significantly affect fish abundance, and attribute population declines in rivers to Endicott or West Dock, while others are not. Fish abundance and presence in the region in a given year may be influenced by larger forces, such as mesoscale wind phenomena and recruitment success in natal streams. Regardless of the conclusiveness about effects of the Endicott and West Dock causeways, individual fish throughout repeated migrations in their life cycle are likely to be stressed by a solid-fill causeway extending into the Beaufort Sea at key locations near barrier islands. Any gravel structure which obstructs the natural migratory corridor near river mouths has the potential to adversely affect anadromous fish. Altering temperature and salinity in nearshore waters may affect the distribution and abundance of organisms upon which fish feed. For these reasons, solid-fill causeways are discouraged, and many designs, although ideal for field development, are unsuitable for the nearshore environment. Additionally, significant alterations of the shoreline or changes to natural temperature and salinity patterns are prohibited.

Oil spills: The shallow nearshore zone of the Beaufort Sea is used extensively by anadromous fish for feeding. If a very large oil spill were to enter into marine waters during the open season it may affect the ability of fish to reach overwintering areas and spawning streams. Adult fish are likely to avoid an oil spill and not suffer great mortality; but larvae, eggs, and juveniles are more vulnerable because they are more sensitive and less mobile. Species with floating eggs, such as Arctic cod, could suffer extensive mortality depending on the extent and amount of oil spilled (MMS, 1996A: IV-B-17). The total number of fish killed depends on the volume of oil discharged, the time of year of the spill, and the prevention, response and preparedness of clean-up efforts.

The deltas of the Colville, Sagavanirktok, and Canning rivers are important habitat for anadromous fishes. Summertime oil spills within river deltas could impact anadromous fish populations. Adult fish are less susceptible to spilled oil and may be able to avoid areas containing spilled oil or dissolved hydrocarbons by swimming upstream. Less motile juveniles in late summer would be near the surface seeking sunlight and warmth. Most anadromous fish migrate downstream to marine waters to feed, and then upstream to spawn. It is not likely that an entire year class would be lost as it migrated in or out of a delta. Furthermore, if a spill affected anadromous river deltas during migration, the spill would likely not affect the entire delta area and, thus, would not affect the entire migration (MMS, 1987: IV-B-16-19).

Seismic activities: Vibroseis is the most widely used method for acquiring seismic data onshore and is limited to the winter season on the North Slope. There may be instances, however, where the use of Vibroseis is not practicable (such as in difficult terrain or if the substrate prevents adequate data collection), and it is necessary to use explosives as an energy source. Generally, using explosives includes the drilling of holes (10 to 50 feet in depth) spaced as close as 100 feet apart and inserting charges (2 to 20 pound charges), and detonating them. Seismic surveys using explosives are conducted in winter, thus it is possible that some terrestrial wildlife (fox, hibernating squirrel) may be exposed to the energy created by the shot blasts. Pressure waves from high explosives, like ammonia nitrate will kill and injure fish, near the explosion (Fink, 1996 citing to Trasky, 1976; Falk and Lawrence, 1973; Hill, 1978). Overpressures 30-40 psi will kill fish with swim bladders, and 3-4 psi will kill juvenile salmonids. Shock waves from explosions can also shock and jar fish eggs at sensitive stages of development (Fink, 1996, citing to Trasky, 1976; Linton et. al., 1985). These types of impacts are mitigated by restricting the use of explosives in open water or in close proximity to fish-bearing lakes and streams.

The chart associated with Mitigation measure 1 (see Chapter Seven), depicting minimum distances from waterbodies for various sizes of explosive charges; represents the minimum distance that explosives can be used without harming fish or eggs, and reflects Alaska Department of Fish and Game Blasting Standards (1991). These standards were generated after a thorough review of literature and represent ADF&G's considered opinion on the maximum allowable blast impact within fish habitat.

The most recent use of explosives for seismic data acquisition was in 1994 near Thetis Island. This was a line to test the Poulter method which consists of charges that are elevated above the surface on stakes. Prior to that, explosives were permitted during seismic surveying in the Barrow gas field in the spring of 1989. A combination Vibroseis/explosives program was conducted in the Kuparuk-West Sak area in the spring of

1987; and, a small program was conducted by ADNR/DGGS in the summer of 1986. ARCO applied for a permit to use explosives for seismic on the Colville Delta in 1995, but that application was withdrawn after a public comment period.

Mitigation Measures.

Title 16 of the Alaska Statutes requires protection of documented anadromous streams from disturbances associated with development. The following are summaries of some applicable mitigation measures. For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories mitigating potential impacts to fish are:

- Habitat Protection -- Lessees may be required to construct ice and/or snow bridges if ice thickness at a crossing is insufficient to protect the streambed and the stream bank. Any removal of water from fishbearing streams, rivers, and natural lakes requires written approval. When a fishbearing waterbody is used as a water source, lessees must use appropriate measures to avoid entrainment of fish (prevent fish from being drawn into the intake pipe). Lessees must locate, develop, and rehabilitate gravel mine sites in accordance with ADF&G guidelines. Disposal of wastewater, such as domestic greywater, into fresh waterbodies is prohibited.
- Production Discharges -- Unless authorized by NPDES or state permit, disposal of wastewater into freshwater bodies, including Class III, IV, VI, and VIII wetlands, is prohibited. Surface discharge of reserve pit fluids will be prohibited unless authorized by ADEC permit and approved by DL. Disposal of produced waters in upland areas, including wetlands, will be by subsurface disposal techniques.
- Stream Buffers -- Onshore facilities other than roads, docks, and airstrips must not be sited within 500 feet of all fishbearing streams and lakes. Facilities may not be sited within 1/2 mile of the Colville, Canning and Sagavanirktok, Kavik, Shaviovik, Kadleroshilik, Echooka, Ivishak, Kuparuk, Toolik, Anaktuvuk and Chandler Rivers. Facilities will be not be sited within 500 feet of all other fishbearing waterbodies. Additionally, facilities may not be sited within one-half mile of identified Dolly Varden both overwintering/spawning areas on the Kavik, Canning and Shaviovik Rivers. Road and pipeline crossings must be perpendicular to watercourses to prevent buffer erosion.
- Obstructions to Migration and Movement -- Continuous fill causeways are discouraged. Causeways, docks or other structures must be designed, sited, and constructed so as to maintain free passage of marine and anadromous fish, and shall not cause significant changes to nearshore oceanographic circulation patterns and water quality characteristics. Causeways may not be located in river mouths or deltas. Activities that may block fish passage in anadromous streams are prohibited. Alteration of river banks, except for approved crossings is prohibited. Operation of equipment other than boats in open water areas of rivers and streams is prohibited. If bridges are not feasible, culverts used for stream crossings must be designed, installed, and maintained to provide efficient passage for fish.
- Protection from Seismic Activities -- Lessees must follow requirements for the use of explosives during onshore seismic activities.
- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, preparedness, response capability, and cleanup of oil spills. Lining and diking of oil or fuel storage tanks is mandatory, and buffer zones are required to separate oil storage facilities from marine and freshwater supplies.

b. Birds

As described in Chapter Three, the Arctic coastal plain's abundant wetlands attract large numbers of important migratory waterbirds each year. Over the years there have been many studies on the effects of North Slope and Beaufort Sea oil and gas development on birds. The results and interpretation of these studies vary.

Some nesting, molting, and staging bird species are sensitive to activities associated with development. Generally, responses to industrial activities depend on species exposed, the physiological or reproductive state of the birds; distance from the disturbance; type, intensity, and duration of the disturbance; and possibly other factors (MMS, 1996: IV-B-21). Potential impacts are more likely to occur after the exploration phase, as few resident species are present during winter when exploration occurs. Potential impacts include: habitat loss, barrier to movement, disturbance during nesting and brooding, change in food abundance and availability, and oil spills.

Habitat loss: Siting of onshore facilities such as drill pads, roads, airfields, pipelines, housing, oil storage facilities, and other infrastructure could eliminate or alter some preferred bird habitats such as wetlands. Onshore pipeline corridors may include a road and associated impacts from traffic, noise and dust may deter nesting in the immediate vicinity. The construction of offshore pipelines or re-supply activities could have temporary effects on the availability of food sources of some birds within a mile or two of the construction area due to turbidity and removal of prey organisms along the pipeline route. Impacts to waterfowl and shorebird populations are not likely to persist after development phase activities are completed (MMS, 1996b: IV-B-23).

After facilities are built, some birds (individuals) can no longer nest in areas because these areas are covered by the new facility. Additional birds may avoid the areas adjacent to the facility due to disturbance effects. However, these habitat changes did not translate into reduced numbers of birds in the area, as the displaced birds were found nesting in nearby areas and returned at rates similar to unaffected birds. There is no indication that displaced birds settled in habitat inferior to that from which they were displaced because they did not incur disproportionately lower nest success at their new nest sites. Habitat availability does not limit most bird populations at Prudhoe Bay. Nest predation by Arctic foxes is proposed as the factor most likely limiting population levels (TERA, 1990:35). The USF&WS disputes this conclusion, citing the small sample size (only one marked bird lost its nest site, and an additional seven had nest sites that were physically altered in some way). They note, however, the results lend no support to the hypothesis of habitat limitation (Sousa, 1997).

A five-year monitoring program to assess the effects of construction and operation of the Lisburne Oil Field on White-fronted Geese, Brant, Snow Geese, and Tundra Swans was conducted from 1985-1990. The purpose was to determine whether development-related disturbance and habitat loss have caused changes in the extent and nature of use of the Lisburne development area by geese and swans. The study concluded that the Lisburne development did not change the extent or nature of use of the area by geese and swans during construction and the first three years of operation of the oil field (Murphy and Anderson, 1993:156). This study synthesized the results from pre-construction studies conducted in 1983 and 1984. The pre-construction studies, however, did not investigate all aspects of goose and swan ecology and therefore a complete comparison with pre-development results was not possible (Murphy and Anderson, 1993:1).

Barriers to movement: Black brant populations have experienced periodic nesting failures in the Sagavanirktok and Kuparuk River deltas (Ott 1993). Adults and young are flightless during the brood-rearing period, so roads, causeways, and other related structures may be barriers to brant movements (Sousa, 1992). There is no evidence that the Endicott road/causeway has been an obstruction to black brant movements (Johnson, 1994:11).

An initial concern expressed before construction began was that the Endicott road/causeway would act as a barrier to the movements of brood-rearing flocks of snow geese as they dispersed eastward from Howe Island after hatching in early July. Overall, 14 years of data show no indication that the Endicott development has impeded eastward movements of snow geese from their nesting colony on Howe Island. This result, and the fact that the snow goose population continues to grow at a rate of almost 30 nesting females per year, indicate no significant population level effects of oil development on the Howe Island snow geese (Johnson, 1994a:29-30). However, other studies document abandonment of brood-rearing areas near the Endicott Road, and unsuccessful crossing attempts and failure of crossing the road for periods up to two weeks (Ott, 1997, citing to EnviroSphere Co., 1986). Many negative behavioral reactions to the road/pipeline corridor were noted, although no population effect was detected (Sousa, 1997).

Disturbance: Human activities such as air traffic and foot traffic near nesting waterfowl, shorebirds, and seabirds, could cause some species to temporarily abandon important nesting, feeding and staging areas. Birds have keen eyesight, and even slight movements may cause adults to abandon young hatchlings. A study of effects of aircraft on molting brant in the Teshekpuk Lake area (Derksen et al. 1992) concludes that helicopters (and to a lesser extent, fixed wing aircraft) cause serious disturbance. However, as pointed out in the Habitat Loss section, disturbance does not translate into a population reduction. Some species such as tundra swans, are particularly sensitive to humans on foot, and may abandon their nests when humans approach within 500 to 2000 m of the nest (MMS, 1996b: IV-B-21).

A study of the Gas Handling Expansion Project (GHX-1) to determine the potential effect of gas-compressor turbine noise on waterbird populations, particularly nesting Canada geese and brood-rearing brant,

concluded that noise from the GHX-1 facility made only a small contribution to the total noise around the Central Compressor Plant and the Central Gas Facility and had little effect on the use of the study area by waterbirds (Anderson et al. 1992:110).

Research has indicated that some birds may not be readily disturbed. A 1993 study, *Bird Use of the Prudhoe Bay Oil field*, concluded that on the order of 5 percent of the birds in the Prudhoe Bay oil field may have been displaced by gravel placement and secondary alterations of adjacent areas, but that these birds most likely occupy nearby areas. Overall there is rearrangement of birds but probably no net change in bird abundance within the oil field (TERA, 1993:48). The nesting of most local birds is widely dispersed over the coastal tundra and disturbance probably would have little effect on North Slope bird populations as a whole (MMS, 1996b: IV-B-21).

In 1985, ARCO Alaska, Inc., initiated a five-year monitoring program to assess the effects of construction and operation of the Lisburne Oil Field on Canada Geese, Greater White-fronted Geese, Snow Geese and Tundra Swans. Pre-construction studies were conducted in 1983 and 1984, however they did not investigate all aspects of goose and swan ecology evaluated during construction and post-construction. In addition, the Lisburne Field is located within the existing Prudhoe Bay oil field, where oil development activities have been ongoing since the early 1970s. The study encompassed the construction phase (1985-1986) and the first three years of operation (1987-1989). The final synthesis report concluded that the Lisburne development did not change the extent or nature of use of the development area by geese and swans during construction during the first three years of operation. No major shifts in the use of the study area were detected when comparing survey results between construction and post construction and the limited data on bird distribution from pre-development studies (ABR, 1993:156).

In 1983, Sohio Alaska stockpiled over one million cubic meters of gravel on the western tip of Thetis Island. Operations also involved the installation of a temporary support camp, construction of helicopter landing pad, gravel berms to support two large conveyor belts and a fleet of barges to haul the gravel. Sohio instituted a series of mitigation measures—the establishment of an aircraft flight corridor and buffer zone, a restricted access zone for camp personnel, and at the request of USF&WS, a program to remove arctic foxes. The numbers of common eiders nesting on Thetis Island in 1983 were higher than had been recorded in any previous year. The mitigation program implemented by Sohio may have been at least partly responsible for the increase. Three eiders established nests and successfully incubated and hatched eggs at different sites within 300 m of the helicopter landing pad (LGL Associates, 1984:50-54).

Oil Spills: Direct contact with spilled oil by birds is usually fatal, causing death from hypothermia, shock, or drowning. Oil ingestion from preening oily feathers or consumption of oil-contaminated foods may reduce reproductive ability, and could lead to chronic toxicity through the accumulation of hydrocarbon residues. Oil contamination of eggs by oiled feathers of parent birds significantly reduces egg hatching through toxic effects on chick embryo or abandonment of the nest by parent birds (MMS 1996: IV-B-19). The presence of humans, aircraft, boat and vehicular traffic involved in cleanup activities is expected to cause displacement of nesting, molting, and feeding birds in the oiled areas and contribute to reduced reproductive success of the birds (MMS 1996: IV-B-23). The number of birds impacted by a spill would depend on the time of year and the density of local bird populations. Spill prevention and response are described in Chapter Six, and would apply to any new development in Sale 87.

Gas Blowouts: In the event of a natural gas explosion and fire, birds in the immediate vicinity could be killed. Blowouts of natural gas condensates that did not burn would be dispersed very rapidly at the blowout site thus, it is not likely that toxic fumes would affect birds or their food sources except those very near to the source of the blowout (MMS, 1996b: IV.L.2).

Mitigation Measures.

The following are summaries of some applicable mitigation measures. For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to birds are:

- **Habitat Protection** -- Lessees must identify and avoid sensitive habitat areas and site permanent facilities outside of identified brant, white-fronted goose, snow goose, tundra swan, king eider, common eider, Steller's eider, spectacled eider, and yellow-billed loon nesting and brood rearing

areas. Permanent facilities must be sited minimum distances from stream and lakes. Lessees must comply with the USF&WS' recommended protection measures for Spectacled eiders during the nesting and brood rearing periods. Lessees are advised to consider identified sensitive bird habitats when planning operations.

- Disturbance -- Lessees are advised that aircraft must avoid identified brant, white-fronted goose, tundra swan, king eider, common eider, and yellow-billed loon nesting and brood rearing habitat, and the fall staging areas for geese, tundra swans, and shorebirds, during critical time periods in summer and fall. NSB Municipal Code requires that vehicles, vessels, and aircraft that are likely to cause significant disturbance must avoid areas where sensitive species are concentrated. Horizontal and vertical buffers will be required where appropriate under local code (19.70.050(I)(1)).
- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, and cleanup of oil spills. Lining, diking and buffer zones are required to separate oil storage facilities from marine and freshwater supplies.

If oil development occurs, some alteration of bird habitat can be expected. However, with state and federal government oversight, any activities within the Sale 87 area should not prevent overall bird population levels from remaining at or near current levels.

c. Caribou

Since 1975, both government and industry have conducted research on caribou biology and on various aspects of their interaction with North Slope oil and gas developments. Population characteristics (calf production and survival, and adult mortality), habitat use, movement and distribution, and behavioral responses of caribou to oil and gas developments have been studied, but there is disagreement regarding the interpretation of data with respect to the effects of oil and gas development. Some researchers attribute declines in caribou populations to oil and gas development, while others think populations (reproduction and viability) are subject to natural cycles in the ability of the land to support large numbers of caribou (carrying capacity). Still others think caribou numbers are influenced by many factors, such as disease, nutrition, predator abundance (including insects), and weather. Hunting pressure and loss of high quality tundra from oil and gas development is not a primary factor in the rise and fall of sale area caribou populations. Nonetheless, studies show that local distribution and behavior of caribou is affected by infrastructure and human activities within producing oil fields.

Potential impacts can occur at all phases, but most are likely to occur during development and production. Adverse effects are discussed below. Potential effects to caribou populations from Sale 87 include displacement from insect relief and calving areas due to construction and operations, and from oil spills.

Disturbance: One source of disturbance to caribou is construction. During construction, small groups of caribou may be temporarily displaced, but the disturbance reaction would diminish after construction is complete. Furthermore, construction will not take place over the entire sale area at the same time. If caribou are displaced from calving in a certain area due to construction, they are likely to calve in an area where construction is not taking place. The use of specific calving sites within the broad calving area varies from year to year. One local resident has testified that there is no core calving area, and that pregnant females will birth their calves wherever they are when its time (MMS, 1996b:V-142). If calving caribou are displaced from high nutrition forage near a drill site or facility, they are likely to seek any protective area regardless of the forage. The cumulative effect of displacement from high value tundra could be lower calf survival. On the other hand, high populations would force the caribou into lower nutrition areas anyway (MMS, 1996b: IV-B-50).

Cow and calf groups are most sensitive to human disturbance just prior to calving, and during the post calving period (Cronin et al., 1994:11). Caribou may use portions of the coastal plain for calving, but most calves are born in the uplands (USF&WS, 1987:24). Ground-vehicle traffic, aircraft, and human presence near cows with newborn calves also affects individuals as they migrate (MMS, 1996b: IV-B-50). According to ADF&G, caribou, particularly during calving, may be more affected by oil development than previously thought (Smith and Cameron 1991).

Motor-vehicle and aircraft traffic can also disturb caribou. Caribou can be briefly disturbed by low-flying aircraft. The response of caribou to potential disturbance is highly variable--from no reaction to violent escape reactions. Reactions depend on their distance from human activity; speed of approaching disturbance

source (altitude of aircraft) and frequency of disturbance; sex, age and physical condition of the animals; size of caribou group; and season, terrain, and weather. Habituation to aircraft and vehicle traffic, and other human activities has been reported in several studies of hoofed-mammal populations in North America. The variability and instability of Arctic ecosystems dictate that caribou have the ability to adapt behaviorally to some environmental changes (MMS, 1996b: IV-B-50).

Aerial surveys of radio-collared females conducted between 1978 and 1987 indicate that parturient females can be displaced by road systems (Cameron, et al., 1992). After construction of the Milne Point road, caribou were significantly less numerous within 1 kilometer of roads and significantly more numerous 5 to 6 kilometers from roads. In addition to the locally perturbed distribution of caribou, researchers observed a decline in relative use of a portion of the study area between Olitok Point and Milne Point roads. However, the causes of reduced use of oil field tundra by calving caribou of the Central Arctic Herd (CAH) is difficult to determine by aerial observations, because of unpredictable random factors, such as weather. "Annual variation in the numbers of caribou observed near Milne Point is primarily an effect of spring snow conditions." (Cameron, et al., 1992:340) Distribution of caribou tends to be skewed inland in years of late snow melt, and concentrated near the coast in years of early melt. In addition to snow conditions and resultant forage availability, relative occurrence of caribou in the Kuparuk River calving area is influenced by predator and insect avoidance behavior. Overall caribou use of an area could be greatly reduced if roads with moderate traffic are routed too closely (Cameron, et al., 1992). "And inaccessible habitat is habitat lost." (Cameron, et al., 1995).

Recent findings of Cameron and Ver Hoef (1996) indicate a trend toward reduced calving activity in the Kuparuk development area compared to the undeveloped area to the east of the Sagavanirktok River. This disparity of use east and west of the Sagavanirktok River may be more pronounced in years of early snow melt, when caribou distribution tends to concentrate near the coastline (Cameron and Ver Hoef, 1996). While some researchers point to the presence of oil field road and associated traffic as a factor contributing to a decline in calving success (Cameron, et al., 1995), recent survey data do not support this claim. A survey of caribou in the Kuparuk oil field during the 1996 calving season indicates that the ratio of calves to cows was the highest recorded since 1985, and was near the maximum recorded for the CAH since calving surveys began in 1978 (Lawhead, et al., 1997).

In the absence of insect harassment, caribou within 1,640 feet of roads with no traffic spent more time feeding than did caribou 1,640 feet and farther from roads with traffic. Avoidance of roads during periods of high traffic in the post calving period was noted by Roby in 1978 and by Dau and Cameron in 1986. Some research has indicated that roads which receive little use by humans need not be separated from pipelines (Curatolo and Reges 1985:35). Pipelines elevated at least five feet allow for effective crossing except when they were in proximity to roads with moderate to heavy traffic (15 or more vehicles/hour). The Alaska Caribou Steering Committee concludes the most effective mitigation is achieved when pipelines and roads are separated by at least 500 feet (Cronin et al., 1994:10). Lessees are encouraged in planning and design activities to consider the recommendations for oil field design and operations contained in the final report of the Alaska Caribou Steering Committee.

Disturbance of caribou associated with cumulative oil exploration (particularly by helicopter traffic) is expected to have minor effects on caribou (particularly large groups) with animals being briefly displaced from feeding and resting areas when aircraft pass nearby. Vehicle traffic associated with transportation corridors has the potential to affect habitat use in intensely developed areas of the Prudhoe Bay and Kuparuk oil fields. Acute disturbance effects may in combination result in a cumulative effect on habitat availability for those individuals with fidelity to the Kuparuk River calving area, but may have little or no effect on the CAH population. Despite the fact that cumulative effects at the population level are difficult to quantify, measures should be incorporated into operations planning and facility design to avoid both direct and indirect impacts to caribou.

Habitat Loss and Displacement: Direct habitat loss will result from construction of well pads, pipelines, roads, airfields, processing facilities, housing and other infrastructure. Caribou are subject to mosquito harassment from mid-to-late June through July, and to oestrid fly harassment from mid-July to late August. In response, caribou move from inland feeding areas to windswept, vegetation-free coastal areas where the insects are limited. Most mosquito relief areas are found within 4.5 miles of the coast (ADF&G 1986b:67). Caribou use various coastal habitats such as sandbars, spits, river deltas, and some barrier islands for relief from insect pests. (MMS, 1987: III-33). Caribou may use some of the barrier islands and adjacent

Oil Spills: The potential effects of oil spills on brown bears include contamination of individual animals, contamination of coastal habitats, and contamination of some local food sources. Bears feed on fish concentrations at overwintering and spawning areas. Bears may also feed on beached marine mammal carcasses along the coast (Ott, 1997). If an oil spill contaminates beaches along the coast, bears are likely to ingest contaminated food sources. In the event of a large oil spill contacting and extensively oiling habitats with concentrations of brown bears, the presence of humans and traffic from vehicles and aircraft are expected to cause disturbance and displacement of brown bears during cleanup operations.

Gas Blowouts: Impacts on brown bear of a gas blowout would be similar to that of other terrestrial mammals. If a natural gas explosion and fire occurred on land or very near the coast, brown bear in the immediate vicinity could be killed or displaced. Blowouts of natural gas condensates that did not burn would be dispersed very rapidly at the blowout site thus, it is not likely that toxic fumes would affect animals except those very near to the source of the blowout.

Mitigation Measures.

The following are summaries of some applicable mitigation measures. For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to brown bear are:

- Waste management -- lessees must use appropriate methods of garbage and putrescible waste disposal to minimize attracting bears.
- Habitat protection -- lessees must avoid conducting exploration or development activities in the vicinity of occupied dens, or obtain approval for alternative mitigating measures.
- Avoidance of human/bear conflicts --- lessees are encouraged to prepare bear interaction plans.

f. Furbearers

Wolves, Wolverines, and Foxes: Fox populations vary in response to fluctuations in their natural prey sources, but a constant food supply could maintain the fox population at artificially high levels. This could cause near total nest failure of all waterfowl and shorebirds in the development area as foxes prey on eggs and young birds. Foxes and wolves, are also noted for their rabies outbreaks, which increase when population densities are high, creating health risks to humans. Activity during exploration and development may attract foraging foxes, and wolves, especially to refuse disposal areas. Wolverines apparently are not attracted to garbage (USF&WS, 1986: 534-537).

Habitat Loss: Winter arctic fox habitat is primarily along the coast and sea ice. Denning occurs up to 15 miles inland. Red foxes also may den within 10 miles of the coast but are generally found farther inland (Ott, 1996). Habitat destruction would primarily affect foxes through destruction of den sites. Placement of oil and gas infrastructure at or near den sites may either destroy den sites or cause foxes to den elsewhere (USF&WS, 1986:533-536). However, foxes have been known to use culverts and other construction materials for denning. Wolverines occur exclusively in remote regions where human activity is unlikely, therefore, displacement of wolverines from local areas of development is likely (USF&WS, 1987:127-128).

The effects of direct habitat loss on wolves would be negligible. The abundance of wolves is ultimately determined by the availability of prey. The ability of adults to provide food is the key determinant in wolf-pup survival. Reduction in prey species, such as caribou, could reduce wolf populations (USF&WS, 1987:126).

Disturbance: Wolves are unlikely to be disturbed by development. Wolves readily habituate to human activity. During construction of the Dalton Highway and TAPS, wolves readily accepted handouts from construction workers (USF&WS, 1987:127). Primary sources of disturbance are seismic activities and aircraft traffic. Helicopters generally invoke a stronger response from wolves and foxes than fixed-wing aircraft. Ice roads connecting well sites and supply areas would provide a source of disturbance from vehicles. Impacts of seismic exploration and drilling on wolverines are unknown (USF&WS, 1986:535).

Oil Spills: The general effects of an oil spill on wolves, wolverines, and foxes are similar to that of other terrestrial animals. The potential effects of oil spills include contamination of individual animals,

contamination of habitats, and contamination of some local food sources. Furbearers, particularly foxes, may be attracted to dead oiled wildlife at a spill site. Foxes may be attracted to the human activity at a spill site by the possibility of finding food or garbage. In the event of a large oil spill contacting and extensively oiling habitats with concentrations of wolves, wolverines and foxes, the presence of humans and traffic from vehicles and aircraft are expected to cause disturbance and displacement of these animals during cleanup operations, with the possible exception of foxes.

Gas Blowouts: Impacts on wolves, wolverines, and foxes of a gas blowout would be similar to that of other terrestrial mammals. If a natural gas explosion and fire occurred on land or very near the coast, animals in the immediate vicinity could be killed or displaced. Blowouts of natural gas condensates that did not burn would be dispersed very rapidly at the blowout site thus, it is not likely that toxic fumes would affect animals except those very near to the source of the blowout.

Mitigation Measures.

The following are summaries of some applicable mitigation measures. For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to wolves, wolverines, and foxes are:

- Habitat protection -- Exploration facilities must be temporary and must utilize ice roads and pads. Facilities may not be sited within waterbody buffers utilized by furbearers.
- Waste management -- lessees must use appropriate methods of garbage and putrescible waste disposal to minimize attracting wolves, wolverines, and foxes.

g. Polar Bear

Potential impact to polar bears include disruption of denning, attraction to areas of activity, ingestion of oil, oil contamination, and adverse interaction with humans.

Habitat loss: Construction of offshore oil and gas facilities such as pipelines, gravel islands, causeways, and production platforms are expected to have local effects on ice movements and fast ice formation around the structures. This will likely have a short term (less than one year) affect on polar bear distribution during construction activities (MMS, 1996b: IV-H-13).

Disturbance: The primary sources of noise disturbance would come from air and marine traffic. Seismic activities and low-frequency noise from drilling operations would also be a source of noise. Disturbance from human activities, such as ice road construction and seismic work, may cause pregnant females to abandon dens early. Early abandonment of maternal dens can be fatal to cubs. If some coastal denning areas in and some maternity dens on the sea ice were abandoned because of noise and human presence near denning areas a short-term (one-generation) disturbance effect on polar bears is expected. However, existing requirements under the MMPA are expected to prevent excessive disturbance of the bears (MMS, 1996b: IV-H-13).

Habitat Modification: Polar bears continually search for food. Once bears find a camp or industrial site, they will often enter to explore and search for food. If a bear receives a food reward, it is almost certain to return. They invariably investigate not only things that smell or act like food, but also novel sights or odors. Subadults are more likely to be food-stressed and, therefore, attracted to human activity more commonly than well-fed bears; they also are less likely to leave if a potential food source is present. Attractants include kitchen odors, deliberate feeding, accessible garbage, sewage lagoons, carcasses, industrial materials, and alteration of habitat (MMS, 1993:13).

Oil contamination: Polar bears have been observed eating hydraulic fluid and other petroleum lubricants, and at least one bear in the Prudhoe Bay area died as a result of ingesting ethylene glycol antifreeze (Ott 1990). Polar bears are extremely sensitive to external and internal oil contamination. Bears may contact oil directly by swimming or wallowing in contaminated areas; and indirectly by scavenging oiled carcasses along the beach, by preying on oiled seals, or while maintaining their fur. It is important for polar bears to keep their fur clean to get the maximum benefit from its insulative qualities (MMS, 1993:12). In the event of a large oil spill contacting and extensively oiling coastal habitats with concentrations of polar bears, the presence of humans (boat, vehicle, and aircraft traffic operating in the area) is expected to cause disturbance and

displacement of polar bears during cleanup operations. However, polar bears may be attracted to a spill site by the presence of dead birds or other animals killed by the spill, or by the human activity previously associated with a food source (MMS, 1996b: IV-B-26).

Adverse interaction with humans: Some polar bears could be killed as a result of human-bear encounters near industrial sites and settlements associated with oil and gas development. Some of these losses are unavoidable and represent a small source of mortality on the polar bear population that would be replaced by reproduction within one year. The incidental loss of polar bears due to oil and gas development in the sale area is unlikely to significantly increase the mortality rate of the polar bear population above that which is occurring due to subsistence harvests and natural causes (MMS, 1996b: IV-H-13).

Polar bears are protected under the MMPA of 1972 (Act). In Alaska, the protection of polar bears under the Act is the responsibility of USF&WS. The MMPA prohibits the "taking" of marine mammals. By interpretation, taking is said to occur whenever human activity causes a polar bear to change its behavior. Disturbing a polar bear by trying to take a picture of it or scaring a bear away from a building are violations under the law (MMS, 1993:61).

Taking a polar bear by individuals is legal under some circumstances, such as federal, state, or local government officials acting in the course of their official duties. Native Alaskans living on the coast are allowed to hunt polar bears for subsistence and handicraft purposes, provided it is not done in a wasteful manner.

In 1987, the NSB Fish and Game Management Committee and the Inuvialuit Game Council of Canada signed an agreement on polar bear management in the southern Beaufort Sea region. Among other measures, the agreement protects bears in dens and family groups with cubs, sets a hunting season, provides a framework for setting annual quotas for each country, and establishes a reporting system. The agreement is voluntary and has no regulatory backing (MMS, 1993:63).

In 1993, amendments to the MMPA made the USF&WS responsible for the conservation of polar bears in Alaska. These amendments allowed for the incidental, but unintentional "take"² of small numbers of polar bears. To comply with the requirements of the "take" regulations, oil and gas activities in Important Habitat Areas in the Beaufort Sea are subject to a Letter of Authorization (LOA) from the USF&WS Regional Director of the Alaska Region. The northern coastal portion of the Sale 87 area has been identified as an Important Habitat Area. The decision to request a LOA is up to the individual operator, although they are liable for incidental takes in the absence of a LOA. LOA's specify terms and conditions appropriate for the conservation of polar bears, such as interaction plans and detection efforts. Through the LOA, USF&WS has the authority to require and specify the type of interaction plans. LOA's are tailored to the individual project and take into consideration factors including the time period and specific location where the activity is to take place.

Bear den and seal lair detection efforts are not required of operators, although these could be imposed at the plan of operations stage. Under terms of Letters of Authorization (LOAs) and Mitigation measure 22b, industry is required to contact USF&WS to compare the locations of known active polar bear dens with industry activities to avoid known dens by one mile, withdraw immediately from any new dens, and report new dens to the USF&WS (USF&WS, 1995:46). Detection methods consist of reconnaissance by snow machine, and aerial surveys. The USGS Biological Survey Division, with assistance from BP and ARCO, is testing forward looking infrared radar. This method, which locates animals by the heat their bodies give off, has successfully detected a 100 watt light bulb placed in a man made den (Schliebe, 1997).

² "Take", as defined by the MMPA, means to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal. "Harass" is defined to mean any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild; or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

Mitigation Measures.

The following are summaries of some applicable mitigation measures. For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to polar bears are:

- Disturbance -- Lessees are advised aircraft must avoid areas where species that are sensitive to noise and movement are concentrated.
- Waste management -- lessees must use appropriate methods of garbage and putrescible waste disposal to minimize attracting bears.
- Habitat protection -- lessees must avoid conducting exploration or development activities in the vicinity of occupied dens. Lessees are advised that certain areas are especially valuable for their concentrations of polar bears and must be considered when developing plans of operation.
- Avoidance of human/bear conflicts -- lessees are encouraged to prepare bear interaction plans.
- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, and cleanup of oil spills. Lining, diking and buffer zones are required to separate oil storage facilities from marine and freshwater supplies.

h. Other Marine Mammals

Despite protective measures, Sale 87 could add to cumulative impacts on ringed, spotted and bearded seals, and walrus. The majority of the North Pacific walrus population occurs west of Barrow, although a few walrus may move east throughout the Alaskan portion of the Beaufort Sea to Canadian waters during the open water season. Spring and summertime oil and gas exploration and development activities in the sale area and elsewhere in the Beaufort Sea could disturb seals and walrus and depending on other human activity in the area, could ultimately contribute to some limited displacement. Both species of seals are commonly distributed throughout the coastal portion of the sale area, and populations vary considerably with seasonal weather changes.

Habitat Loss: Some pinnipeds could be temporarily displaced by construction activities associated with causeway construction. Onshore development near the coast could also disturb a small number of pinnipeds. However, the amount of displacement is likely to be very small in comparison with the natural variability in seasonal habitat use and is not expected to affect seal populations. Effects are likely to be one year or season or less with any disturbance of pinnipeds declining after construction activities are complete (MMS, 1996b:IV-B-30).

Disturbance: The primary sources of noise and disturbance of pinnipeds would come from marine traffic, air traffic, and geophysical surveys. A secondary source would be low frequency noises from drilling operations. Boat traffic could disturb some pinnipeds concentrations. However, such traffic is not likely to have more than a short-term (a few hours to a few days) effect. Helicopter traffic is assumed to be a source of disturbance to pinnipeds hauled out along the beaches of the Colville River Delta and other haulout areas. Such brief occasional disturbances are not likely to have any serious consequences. Noise and disturbance from seismic operations could cause a brief disturbance response from seals and walrus. However the affected animals are likely to return to normal behavior patterns within a short period of time (MMS, 1996b:IV-B-29).

Oil Spills: Direct contact with spilled oil by pinnipeds may result in some mortalities. If newborn seal pups come in contact with oil, they may lose their thermo-insulation capabilities and die from hypothermia. Adults may only suffer from temporary eye and skin irritations. The specific effects would depend on many factors, including the seal's age and health. Seals are known to be capable of metabolizing as well as excreting and absorbing oil. In general, deaths from contact with oil among adult seals are most likely to occur during periods of high natural stress such as during the molting season or times of inadequate food supply or if affected by disease (MMS, 1987). The measures outlined above for whales will also protect seals and will reduce the likelihood that oil spills or human activity associated with oil and gas exploration and development activities could adversely affect marine mammals such as ringed seals. In the event of a large oil spill contacting and extensively oiling coastal habitats with concentrations of pinnipeds, boat, vehicle, and aircraft traffic operating in the area is expected to cause disturbance and displacement of pinnipeds during cleanup operations. If operations occurred in the spring they would contribute to increased stress and reduced pup survival of seals (MMS, 1996b:IV-B-26).

Mitigation Measures.

For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to pinnipeds are:

- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, and cleanup of oil spills. Lining, diking and buffer zones are required to separate oil storage facilities from marine and freshwater supplies.

3. Effects on Subsistence Uses

Traditional subsistence uses include bowhead and beluga whaling; walrus, polar bear and seal hunting; brown bear, caribou, musk ox, and moose harvesting; hunting and trapping of furbearers, such as wolf, fox, weasel, wolverine, and squirrel; the taking of migratory waterfowl and their eggs; the fishing of whitefish, char, salmon, smelt, grayling, trout, and burbot; the collection of berries, edible plants, and wood; and the producing of crafts, clothing, and tools made from these wild resources. Subsistence also includes social activities of consuming, sharing, trading and giving, cooperating, teaching and celebration among members of the community.

Direct effects on subsistence uses may include increased access and land use limitations, less privacy, immediate effects of oil spills, and potential increase in wage earning opportunities to supplant subsistence activities. Indirect effects include the potential reduction in local fish and wildlife populations due to development, increased travel distance and hunting time required to harvest resources, potential reductions in harvest success rates, increased competition for nearby subsistence resources, improvements in community transportation, trade, and utilities infrastructure, and increased revenues to local government through petroleum revenue taxes.

Alteration of the physical environment may affect migration, nesting, breeding, calving, denning and staging of animals which are sensitive to oil and gas development activities. For example, noise propagation from jet aircraft is known to affect the behavior of molting waterbirds. Above-ground pipelines can disrupt annual caribou migrations if not elevated properly or buried. Vehicle traffic may adversely affect foraging caribou by displacing them from preferred forage areas. Such effects can be reduced or avoided by observing mitigation measures which restrict oil and gas activities.

Other physical alterations of the environment from post-sale activity could affect subsistence. If a road adjacent to a pipeline was heavily traveled (as in during a project's construction phase), caribou may avoid the area of higher vehicle activity. The result could be that a subsistence hunter may have to travel farther from the village in order to capture the affected caribou. Another example might be the industrial use of water, which could affect the drainage pattern of a river distributary, thereby affecting a particular anadromous fish run which happens to be a part of a commercial or subsistence fishery.

Any activity which has the potential to harm fish or wildlife has the potential to affect subsistence. Mitigation measures have been designed to avoid, reduce or minimize biological alterations to the sale area. Reducing impacts to subsistence resources from oil and gas development is a primary goal in lease sale planning. The objective of protecting subsistence uses lies in protecting cultural and biological resources (See previous subsection of this chapter and the following subsection).

The effects of an oil spill on marine mammals and fish is the most feared adverse impact from oil and gas development offshore. Residents are concerned that the technology does not exist to clean up a major spill, which, regardless of the time of year, would not be possible to fully clean up and which would have incalculable effects on subsistence resources. Residents, having witnessed decades of sea-ice activity, continue to question the structural integrity of drill rigs in the face of tremendous ice forces. An older resident observed sea ice suddenly rise up a 20 foot bluff, threatening homes in Barrow (MMS, 1996b:V-141).

Fish, such as Arctic cisco or broad whitefish which utilize portions of the sale area for migration and feeding, could also be affected by excessive disturbances from some oil and gas activities, such as causeways or oil spills. These fish could be directly damaged, or otherwise made less accessible to subsistence fishers. The inability to harvest seals or other marine mammals due to avoidance behavior or loss of supporting habitat could affect subsistence uses other than for food consumption, such as use of seal skins for covering umiaks,

or skins and furs for clothing, and handicrafts. Traditional whaling harvests are not expected to be affected by post-sale activities.

Community well-being depends on the continued use of subsistence resources because they are culturally and economically significant. The subsistence way of life, with its associated values of sharing food and its influence on the extended family and traditional knowledge, is considered an integral part of being Inupiat (Kruse and others 1983:185). In addition to this cultural component, subsistence is the direct source of economic well being for NSB residents. Subsistence resources enter into household income as a food source that does not have to be purchased. A loss of subsistence resources would be a loss of income for the entire community (MMS, 1996b:IV-B-57).

Previous subsections of this chapter describe the potential impacts to fish and wildlife populations due to habitat loss, disturbance, oil spills, and gas blowouts. They also discuss the mitigation measures that will be imposed on Sale 87 to maintain fish and wildlife populations. Additional site-specific and project specific mitigation measures may be required later if exploration and development take place.

As new discoveries are made, the number of development-related facilities will increase, and portions of the developed areas could be closed to public access, reducing the area available for subsistence activities. If subsistence hunters are displaced from traditional hunting areas they might have to travel greater distances and spend more time harvesting resources. At the same time, increased public access to hunting, fishing, and trapping areas, due to construction of new roads, could increase competition between user groups for subsistence resources. If competition for scarce resources, like moose, on the North Slope were to increase, game managers would restrict non-subsistence hunting and fishing. Management practices to restrict non-local resident hunting are in place for Game Management Unit 26. See Chapter Four for a description of sport hunting and fishing in the sale area.

Impacts on subsistence usage from oil and gas exploration, development, production, and transportation depend on Sale 87 mitigation measures, operator and lease holder company policies, and all applicable wildlife conservation and protection laws. Additionally, Alaska Air Quality Control regulations may require temporary air exclusion zones around new facilities identified under 18 AAC 50.300. ADEC may require as a condition of permit approval, air exclusion zones around facilities and operations that exceed allowable emissions. Operators may be required by ADEC to restrict public access within 1.5 kilometers of such facilities. All plans of operations proposals (approval of these plans is required before any exploration or development activity can begin) are reviewed for consistency with applicable laws, including the Alaska Coastal Management Program and North Slope Borough Coastal Management Plan (NSBCMP). The entire Sale 87 Area is located within the NSB Coastal Management Zone. The NSBCMP Standards for Development Policy 2.4.3(d) states, "Development shall not preclude reasonable subsistence user access to a subsistence resource." For a complete review of this sale's consistency with coastal management plans, see "Alaska Coastal Management Program Consistency Analysis Regarding Proposed Oil and Gas Lease Sale 87, North Slope Areawide."

ACMP standards are applied at the lease sale stage and they will be reapplied at all future phases. Under 6 AAC 80.120, Coastal Management Districts must identify areas in which subsistence is the dominant use of coastal areas and resources. Under (d) of that section, a study of the possible adverse impacts of the proposed potentially conflicting use or activity upon subsistence usage must be conducted for these designated areas and safeguards must be appropriated to protect the subsistence usage priority. This applies when an activity, use or project is actually proposed.

Subsistence conflict resolution --Prior to initiating any activity that may disrupt subsistence harvesting, lessees must consult with the affected community to discuss potential conflicts before plans of operation are approved. Lessees are advised to consult with the NSB when planning operations and generate potential solutions to problems. The parties must discuss the reasonably foreseeable effect on subsistence activities of any other operations in the area that they know will occur during the lessee's proposed operations. A discussion of resolutions reached and plans for continued consultation shall be included in the plan of operations. If the parties cannot agree, the commissioner or his representative may assemble them. Lessees are advised that interfering with reasonable access to subsistence resources violates the ACMP and NSB Municipal Code.

Mitigation Measures.

The following are summaries of some applicable mitigation measures. For a complete list of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to subsistence are:

- Harvest disruption --Copies of seismic permit applications will be made available to the NSB, AEWC, and potentially affected subsistence communities for comment. Lessees are advised that interfering with reasonable access to subsistence resources violates the ACMP and NSB Municipal Code. Aircraft must avoid sensitive bird habitat, and vertical and horizontal buffers separating aircraft from waterfowl, caribou, and muskoxen may be required. Identified sensitive habitats must be avoided and potential adverse impacts considered in operations planning. Lessees must comply with seasonal drilling restrictions in identified subsistence whaling zones, and coordinate activities with local whaling captains..
- Historic and Archaeological Site Preservation -- Lessees must conduct an inventory of traditional use sites in the area proposed for activity and ensure that archaeological resources are preserved. Lessees must include in any development plan, a program to educate oil field workers about community values, customs, lifestyles, and laws protecting cultural resources in the proposed sale area.
- Unrestricted access -- No restriction of public access to, or use of, the proposed lease sale area due to oil and gas activity will be permitted, except within the immediate vicinity of drill sites, buildings and other related facilities. Any area of restricted access must be justified in the plan of operations.
- Oil Spill Prevention and Response -- In addition to addressing the prevention, detection, and cleanup of releases of oil, contingency plans (C-Plans) include methods for detecting, responding to, and controlling blowouts; the location and identification of oil spill cleanup equipment; the location and availability of suitable alternative drilling equipment; a plan of operations to mobilize and drill a relief well.
- Harvest conflict resolution -- lessees must cooperate with agencies and the public to avoid conflicts by selecting alternative sites or implementing seasonal restrictions on certain activities, and by siting permanent facilities a minimum distance from rivers. Prior to initiating any activity which may disrupt subsistence harvesting, lessees must consult with the affected community before plans of operation may be approved. Lessees are advised to consult with the NSB during planning of operations.
- Community participation -- Lessees are advised to bring local residents into their operations planning process. Residents can provide critical input and traditional knowledge to operations and oil spill prevention and response plans. Community representation on management teams facilitate understanding and the transfer of information between the lessee and the residents.

4. Effects on Historic and Cultural Uses.

Cultural and historic resources are those sites and artifacts having significance to the culture of Arctic people. Historic and cultural sites are those identified by the National Register of Historic Sites, and include those identified in the NSB Traditional Land Use Inventory (TLUI), by the Commission on Inupiat History, Language and Culture, and sites identified in other published studies. Many places, such as ancient village locations along the distributaries of the Colville River, which contain archaeologically important relics continue to be used today. Information regarding important cultural and historic sites can be obtained by contacting the North Slope Borough Planning Department. See also Hoffman, et al., (1988), Jacobson and Wentworth (1982), the Nuiqsut Cultural Plan (NSB, 1979b), and the NSBCMP Background Report and Coastal Resource Atlas (NSB 1984:b) and the NSB Municipal Code (NSBMC 19.70.050(E)).

Under NSB Land Management Regulations, any proposed development project shall not impact any historic, prehistoric or archaeological resource prior to an assessment of that resource by a professional archaeologist (NSBMC 19.50.030(F)). Additional protection from development disturbance is assured under NSBCMP Policy 2.4.3 to "sites eligible for inclusion in the National Register; or sites identified as important to the study, understanding, or illustration of national, state or local history or prehistory..." Finally, under NSB Land Management Regulation 19.70.050(F), "Development shall not significantly interfere with traditional activities at cultural or historic sites identified in the NSBCMP. These provisions give the NSB significant authority to protect both cultural historic resources, and current subsistence uses of these sites.

Potential impacts could occur in either the exploration, development, or production phases, but are more likely to occur if development occurs. Impacts include disruption of culture and disturbance of historic and archeological sites.

a. Historic use and archeological sites

The Alaska Heritage Resources Survey is an inventory of all reported historic and prehistoric sites within the state of Alaska. This inventory of cultural resources includes objects, structures, buildings, sites, districts, and travelways, with a general provision that they be over 50 years old. By knowing of possible cultural remains prior to construction, efforts can be made to avoid project delays and prevent unnecessary destruction. Listing on the AHRS does not, in and of itself, provide protection for sites.

For each individual site, the Office of History and Archaeology maintains a site record card containing such information as the site name, a description of the physical remains, data on the site's location, and list of bibliographic citations, as well as a variety of additional information relevant to management and research needs. DO&G has researched the available resources and found there are approximately 52 known historic or prehistoric sites in the sale area. There is a high potential for the discovery of additional sites. Carbon dating revealed that one site had artifacts nearly 6,000 years old (DPOR, 1997).

b. Disturbance

Impacts may be caused by surface vehicle traffic, construction activity associated with drill pads, roads, airstrips, pipelines and processing facilities. Damage to archaeological sites can include direct breakage of cultural objects, damage to vegetation and 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 archeological or historic sites could damage or destroy sites by collecting artifacts (USF&WS, 1986:537-539).

Many sites along the coast are currently eroding into the sea. Storm surges during the summer and fall open water season have caused rapid coastline erosion. Sediments are reworked to varying depths by current transport and ice gouging which makes the survival of any prehistoric sites offshore unlikely (MMS, 1996b: III-C-21).

c. Oil Spills

Oil spills can have an indirect effect on archaeological sites by contamination of organic material which would eliminate the possibility of using carbon dating methods (USF&WS, 1986:537). The *Exxon Valdez* oil spill cleanup demonstrated that archaeological resources generally were not directly affected by the spill. The largest effects came from vandalism, because more people knew about the location of the resources and were present at the sites. That knowledge increased as the population and activities increased during the cleanup process (Bittner, 1993).

The detrimental effects of cleanup were slight during the *Exxon Valdez* oil spill because the work plan for cleanup was constantly reviewed, and cleanup techniques were changed as needed to protect archeological and cultural resources (Bittner, 1993).

d. Gas Blowouts

Disturbance to historical and archeological sites might occur as a result of onshore activity associated with accidents such as a gas blowout or explosion. Cleanup after such accidents could result in disturbance by cleanup workers in the vicinity of the accident site. Archeological resources in the immediate vicinity of the blowout might be destroyed.

"It is the policy of the state to preserve and protect the historic, prehistoric and archeological resources of Alaska from loss, desecration and destruction . . ." AS 41.35.010. Existing statutes, which apply to both known sites and newly discovered sites, are:

- AS 41.35.200(a) prohibits a person from unlawfully appropriating, excavating, removing, injuring or destroying any historic, prehistoric, or archeological resources of the state. "Historic, prehistoric, or archeological resources" include "deposits, structures, ruins, sites, buildings, graves, artifacts, fossils,

or other objects of antiquity which provide information pertaining to the historical or prehistoric culture of people in the state as well as to the natural history of the state." AS 41.35.230(2). Violators of this statute are subject to criminal (misdemeanor) penalties and civil penalties (fines up to \$100,000 per violation). AS 41.35.210, 215.

- AS 41.35.200(c) prohibits 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. Violators of this statute are subject to the same penalties listed above for AS 41.35.200(a) [historic, prehistoric and archeological resources].

Mitigation Measures.

The following are summaries of some applicable mitigation measures. For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to historic and cultural uses are:

- Education -- lessees are required to conduct training for all employees and contractors on environmental, social, and cultural concerns in the sale area.
- Protection of historic and archeological sites -- prior to exploration activities involving ground disturbance, and subsequent development, lessees must conduct an archeological inventory. If any objects are discovered at any time, they must be reported, and appropriate protective measures followed.

C. Effects on Municipalities and Communities

The lease sale and subsequent activities may affect municipal governments by shifting spending or planning priorities, increasing or decreasing demand for a public service, or by expanding their functional roles, such as accounting, collecting new taxes, inter-governmental representation, and regulatory oversight. The sale and subsequent activities may also affect people in communities within or near the sale area. Oil and gas exploration, development, production, and transportation may affect patterns of subsistence use, access to village environs, occupations and income, and perceptions of culture.

1. Effects on Municipalities

a. Public Services and Employment

Considering the NSB provides all public services (with the exception of parks and recreation) to Nuiqsut, Kaktovik, and Anaktuvuk Pass, the impact on those city governments is likely to be minimal. However, post-sale activities may require staff time if projects are proposed within city limits, on city property, or within the village's zone of influence.

If projects are proposed, one or more members of the city council or administrative staff may want to represent the village at meetings. Some planning work, such as reviewing and commenting on documents and project oversight may serve the interests of the community if development were proposed within the village zone of influence. Lessees are advised to include a member of the affected community in their planning process. Some NSB staff may be needed to participate in wildlife studies, peer reviews, or community outreach programs sponsored by lessees if the proposed project has the potential to impact natural resources or local employment levels.

The NSB provides services to residents of the sale area including health care, emergency medical services, public education, electricity, water service, sanitation, housing assistance, and public works. Exploration and development activities require labor and capital-intensive infrastructure. An increased presence of oil field workers may increase demand for a public service, like housing or sanitation, in communities where oil field development services are based, such as Barrow. However, in the sale area, development projects are normally stand alone self-sufficient operations or might be supported by existing infrastructure near Deadhorse, and would therefore place no additional burden on public services.

The communities of Nuiqsut, Kaktovik, Anaktuvuk Pass, and Barrow could provide some labor needs if projects are proposed, approved, and developed. Although unlikely, a very large project coupled with an

effective local hire initiative could draw labor away from local government positions for the NSB and village governments. Locally owned and operated oil field support companies may also provide services to lessees or operators. As with the Alpine development project, located near Nuiqsut, local contracts for services, such as gravel, can be made in advance of project approvals.

b. Land Use

The entire Sale 87 area is located within the North Slope Borough. During the pre-exploration phase, applications for seismic and possibly exploratory drilling permits may be submitted to the DO&G and other resource agencies for review. Pre-exploration includes reconnaissance activities related to resource extraction including surface geologic mapping, surveys other than seismic surveys and geologic sampling. This includes samples taken by hand or lightweight equipment that does not penetrate the tundra or submerged lands to a depth of more than 50 feet (NSBMC 19.20.020).

The NSB Resource Development District is a zoned area which encompasses all oil fields that are currently producing. If any activity were proposed on leases located outside the NSB's Resource Development District, the borough's Zoning Commission would have to approve the development, and a public hearing would be held. Applicants must provide a Master Plan of development to the NSB Zoning Commission for approval. This plan must include maps and analysis of ownership status, and an analysis of impacts the development would have on the zoned district. The same development proposal would also require numerous state and federal permits, and a comprehensive CMP consistency review would be initiated for the project.

The NSB Coastal Management Plan's policies and development standards have been adopted verbatim into Title 19 of the Municipal Code. The NSB and all communities within would be affected by any increase (or decrease) in petroleum revenues derived from post-sale production.

2. Effects on Communities

a. Subsistence Use Patterns

Subsistence activities, including hunting and fishing, are described in Chapter Four. There is low potential for interference with hunting and fishing due to the timing of development or the placement of structures. Most recreation in the area occurs during summer, while development would occur during winter. If development occurs, major energy facilities must be consolidated, as required under the ACMP and area use conflicts would be reduced. The "visual, environmental, social, and economic effects are concentrated," and are "less complicated and less costly" (ADCRA 1978:31). Impacts to Subsistence uses are discussed in previous subsections.

b. Physical Impacts and Access

At the lease sale phase there will be no physical impacts on municipalities and communities, except for administrative work involved in the transfer of some leases if those leases are jointly owned by the state and ASRC. For some residents, anticipation of future development conjures up images of opportunity, while for others it means that present activities and life-styles are threatened.

For activity on leases near Nuiqsut, residents may notice increased presence of company personnel. If a project is approved, residents may notice increased use of the community airstrip by small aircraft in earlier phases, and larger C-130 Hercules aircraft and helicopters during the construction phase. If the project site is remote, village residents may see and hear aircraft in the distance or may notice aircraft if the project site is near a traditional use site. In summer, residents may notice increased barge and supply vessel traffic offshore. They may also see and hear associated support vessels and helicopters.

Local residents' use of the sale area depends on access to the area. Development of the sale area could adversely affect human uses of the area and its 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. For this reason, Mitigation Measures to protect use and access to resources are proposed. Conversely, development of the Sale

87 area could actually increase public access for users of the area's resources. If roads were constructed across state land, they might be open to the public and available for multiple use activities.

In winter, residents may notice or come upon construction work camps while traveling outside of the village. If a pipeline or road project was approved, they may have to steer clear of a pipeline project while it was under construction, but should be able to move freely about the region after production of oil or gas begins. If above-ground pipelines are proposed, they must be a minimum of five feet high. Residents may also see the use of ice roads by trucks and machinery in winter.

c. Occupational Change

An increase in job opportunities could pull residents away from other community-oriented occupations or responsibilities if the project were large. Residents who take oil field jobs or subsequent petroleum revenue-funded jobs may have less time to participate in subsistence activities. If the pattern of social change resulting from Prudhoe Bay and Kuparuk holds for this lease sale, it is unlikely that an increase in oil field jobs will erode the existing subsistence participation level in a community.

Some residents may be actively involved in construction camp and development site planning. They would be asked to provide information as to the locations of fishing, trapping and hunting camps, and historic sites, like graves which may be near a proposed development site. Some residents may participate in the construction and production workforce, especially on projects where NSB, and regional and village corporation companies have secured contracts with operators. Other residents would not be involved directly in effects of nearby development, but may be affected indirectly. For example, children and young adults may be affected if a parent who previously spent more time in the household now spent long days working at a project site. Some residents may feel that every day life is disrupted if, for example, instead of doing normal day to day activities, they felt compelled to engage in planning processes to protect village interests. Lessees are required to consult with community representatives if a proposed project has the potential to conflict with subsistence uses. Lessees are required to recruit local hire and contract with local service providers if available. They are also advised to include members of the community in their operations planning process. Additionally, they are required to conduct extensive wildlife and subsistence use studies before construction or production drilling is approved by agencies.

It is impossible to predict if any of these activities or effects will occur as a result of Sale 87, but if discoveries are made and a development project proposed, mitigation measures will be imposed on all plans of operation. Site or issue-specific restrictions may also be imposed by the state, NSB, or federal authority where jurisdiction applies. Additionally, if a project is proposed, a site-specific proposal must undergo a multi-agency ACMP review. Public input would be solicited in numerous hearings in affected coastal districts. Some residents would be involved directly, including local government employees and oil field workers, while others would choose not to participate at all.

d. Cultural Change

Throughout the era of oil development in the Arctic, local residents and community representatives have expressed concern that the integrity of Inupiat culture, with its basis in subsistence use, is threatened. Forces identified as converging upon the Inupiat way of life are: competing interests, oil and gas development, environmental degradation, access and use limitations, land tenure problems, socio-economic instability, and loss of cultural privacy (NSB, 1979b). These issues are still of concern today.

Some issues of concern can be addressed at the lease sale phase with mitigation measures, while others are beyond the scope of a lease sale. For example, land tenure and competing interests may have roots in the history of congressional action in Alaska, not in oil and gas development or production activities per se. Concern that environmental degradation, and access and use restrictions will undermine the subsistence way of life can be addressed in lease sale planning to the extent that they are caused by post-sale activities. Socio-economic stability as a goal of the state's leasing program can be achieved through petroleum revenues, like oil and gas property taxes. This goal is further realized by ongoing efforts of the NSB to diversify its work force and economy so as to be less dependent on oil revenues.

That cultural change has occurred as a result of increased human presence on the North Slope cannot be denied. Western tools and institutions have altered traditional subsistence patterns. Today's subsistence

culture blends old and new, with cash wages used to supplant household income and income used to acquire modern machinery and supplies for subsistence activities. Thus, the potential for cultural change resulting from post-lease sale activities exists.

Measures to protect subsistence resources and maintain environmental quality, beyond protections already afforded by law are described in Chapter Seven. Minimizing, reducing, and avoiding impacts to the human environment are addressed below.

Mitigation Measures

The following are summaries of some applicable mitigation measures. For a complete, full text listing of Sale 87 mitigation measures see Chapter Seven. Lease sale plan of operation terms and lessee advisories that would mitigate potential impacts to municipalities and communities are:

- Environmental Protection -- Numerous measures are designed to protect environmental quality and the habitats which support important subsistence resources. Other measures are designed to protect key species, like caribou, whales, birds, and fish, from potential adverse effects of oil and gas activities.
- Access to Resources -- Restricting access to subsistence resources is prohibited under ACMP and local ordinances. Access to identified traditional use sites shall not be infringed. No restriction of public access to, or use of, the lease sale area as a result of oil and gas activity will be permitted, except within the immediate vicinity of drill sites, buildings and other related facilities. Any area of restricted access must be justified in the plan of operations.
- Subsistence Conflict Resolution -- Prior to initiating any activity which may disrupt subsistence harvesting, lessees must consult with the affected community before plans of operation can be approved. Lessees are advised to consult with the NSB when planning operations and generate potential solutions to problems. A discussion of resolutions reached and plans for continued consultation shall be included in the plan of operations. Lessees are advised that interfering with reasonable access to subsistence resources violates the ACMP and NSB Municipal Code.
- Community participation -- Lessees are advised to bring local residents into their operations planning process. Residents can provide critical input and traditional knowledge to operations and oil spill prevention and response plans. Community representation on management teams facilitate understanding and the transfer of information between the lessee and the residents.
- Cultural Awareness -- Lessees are required to conduct a training program for all personnel, including contractors and subcontractors, involved in any activity. The program must be designed to inform each person working on the project of environmental, social, and cultural concerns which relate to the individual's job. In addition, the program must also be designed to help personnel increase their sensitivity and understanding of community values, customs, and lifestyles in areas where they will be operating. The program must include an explanation of the applicable laws protecting cultural and historic resources.
- Protection of Historic and Archeological Sites -- prior to exploration activities involving ground disturbance, and subsequent development, lessees must conduct an archeological inventory. If any objects are discovered at any time, they must be reported, and appropriate protective measures followed.
- Economic Security -- Lessees are encouraged to employ local and Alaska residents and contractors. Plans of Operations must include a prescription for partnering with local communities in recruiting and hiring Alaska residents and contractors. Lessees are advised to bring local residents into their operations planning process. Residents can provide critical input and traditional knowledge to operations and oil spill prevention and response planning. Community representation on management teams facilitate the transfer of information, intentions, and values between lessees and residents.

D. Fiscal Effects

Financial effects are generated from (1) direct expenditures made by firms in connection with the lease, and (2) petroleum revenue taxes, and subsequent local and state government spending. Cumulative effects of industry expenditures and petroleum revenues are felt by state government and local governments and their beneficiaries.

Direct expenditures in turn stimulate ancillary spending in the economy as contracts for goods and services are fulfilled. Economic effects are generated by industry spending throughout the life of the project or

field recovery. State revenues are generated immediately after the lease sale with bonus bids and first-year rents. After production begins, state revenues are derived from royalty and severance taxes, and oil and gas property taxes.

1. State Petroleum Revenues

Alaska's economy depends heavily on oil and gas related revenues and resultant government spending. The state government receives revenues from oil and gas lease bonus bids, rentals, and royalties; production taxes; and corporate income taxes. Lease sales ultimately generate income to the state in these ways. Some of these—bonus bid payments, rentals, and to a certain extent, corporate income taxes—are generated for each lease sold, regardless of whether a discovery is ever made or production established.

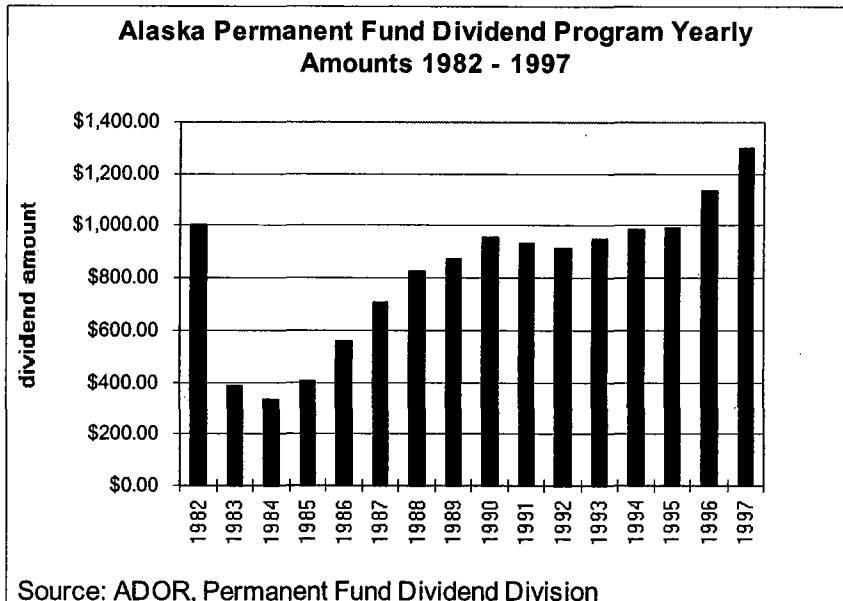
1. **Bonus Payments.** These are the amounts paid by winning bidders for the individual tract lease at a lease sale. Since 1959, 4,963 tracts have been sold, generating more than \$1.95 billion in bonus bid income to the state.
2. **Rentals.** Each lease requires an annual rental payment. The first year rent is \$1.00 per acre or fraction of an acre, and the rent increases in 50¢ increments to \$3.00 per acre or fraction of an acre in the fifth and all following years of the lease. The lessee must pay the rent in advance and receives a credit on the royalty due under the lease for that year equal to the rental amount. Rental income for fiscal year 1997 amounted to \$4.4 million (ADNR, 1997b).
3. **Royalties** represent the state's share of the production as the mineral interest owner. Royalty payments provided over \$1 billion in revenue to the state in fiscal year 1997.
4. **Production taxes.** All producers must pay tax on all taxable oil and gas produced from each lease or property in the state on a percentage-of-gross value basis. For fiscal year 1997, oil and gas production taxes were \$888.7 million (ADOR, 1997:34)
5. **Income taxes.** All corporations in the state must pay corporate income tax for 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.

Together these revenues comprised approximately 75 percent of the state's general fund unrestricted revenue for the past 19 years, and 81 percent of the total generated fund unrestricted revenue in fiscal year 1997. Such revenues finance the state's revenue sharing, municipal assistance, education funding, operating budget and capital budget (ADOR, 1997:17)

State spending supports nearly one out of every three jobs, and three of every ten dollars of personal income result from state spending. Nearly one of every two local government jobs (including school district jobs) in Alaska relies on state funding (ISER 1990:1,4). Oil and gas royalties and revenues also contribute to the Alaska Permanent Fund, which pays significant dividends each year to every qualified state resident.

The Alaska Permanent Fund was established by ballot proposition in 1976. At least 25 percent of all mineral lease rentals, royalties, royalty sale proceeds, federal mineral revenue sharing payments, and bonuses received by the state are placed in the permanent fund. All qualified Alaskans who apply, receive an annual dividend from the earnings of the permanent fund. In 1997, every qualified man, woman, and child in Alaska received a dividend check of about \$1,300. The PFD is an equitable benefit transfer because it reaches every individual regardless of income or socio-economic status (see Figure 5.5). The permanent fund continues to support Alaska families and the state economy.

Figure 5.5 Alaska Permanent Fund Dividends

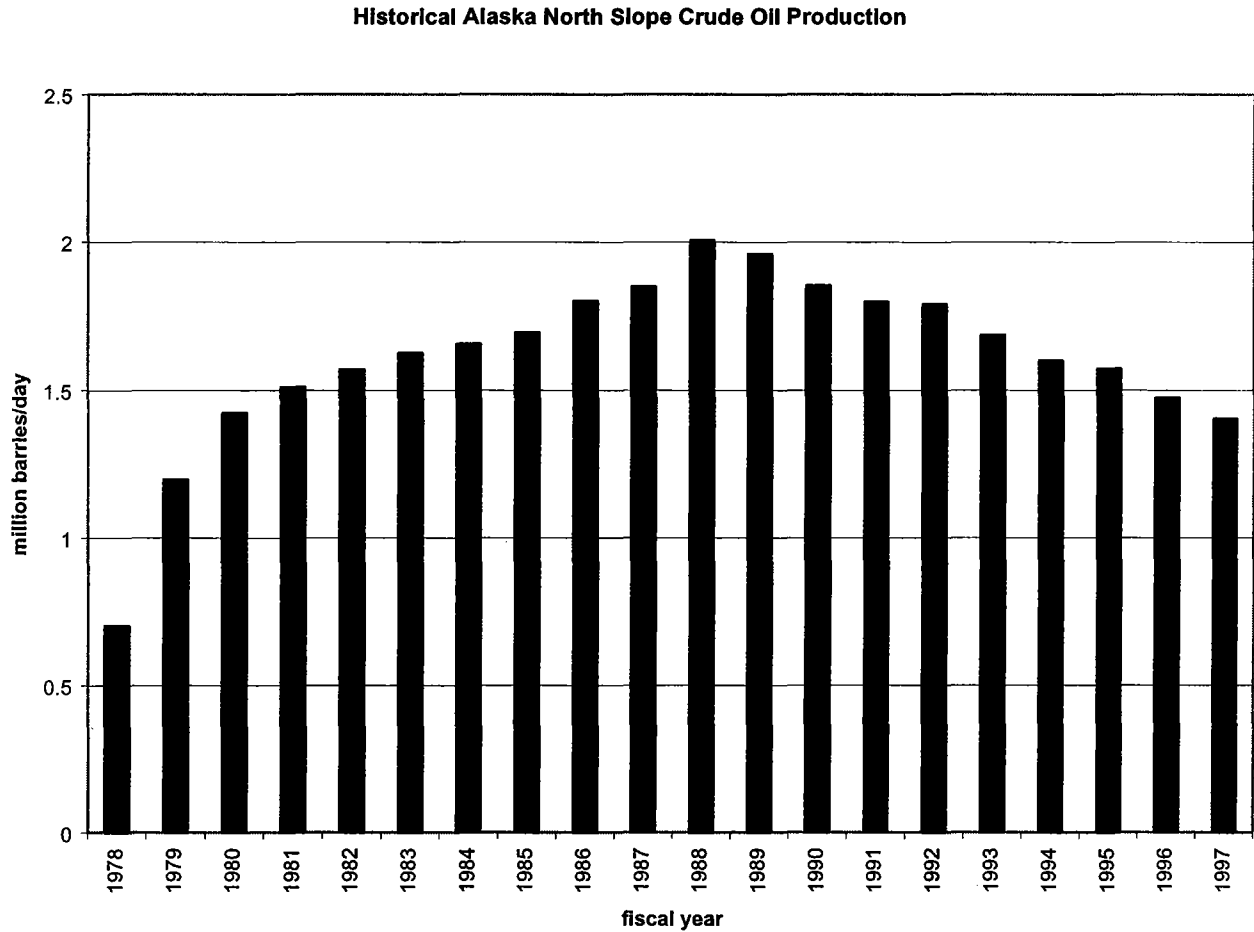


The total economic effect of any spending, including state government spending and salaries paid to private oil and gas industry employees, is always greater than the direct effect. When money is re-spent in the economy, its original value multiplies. For example, this "income multiplier" is calculated at 1.35 for state spending. This means that for every dollar of income Alaskans receive directly from state spending, an additional 35 cents of income is generated when that dollar is re-spent in the local economy (ISER 1990:3).

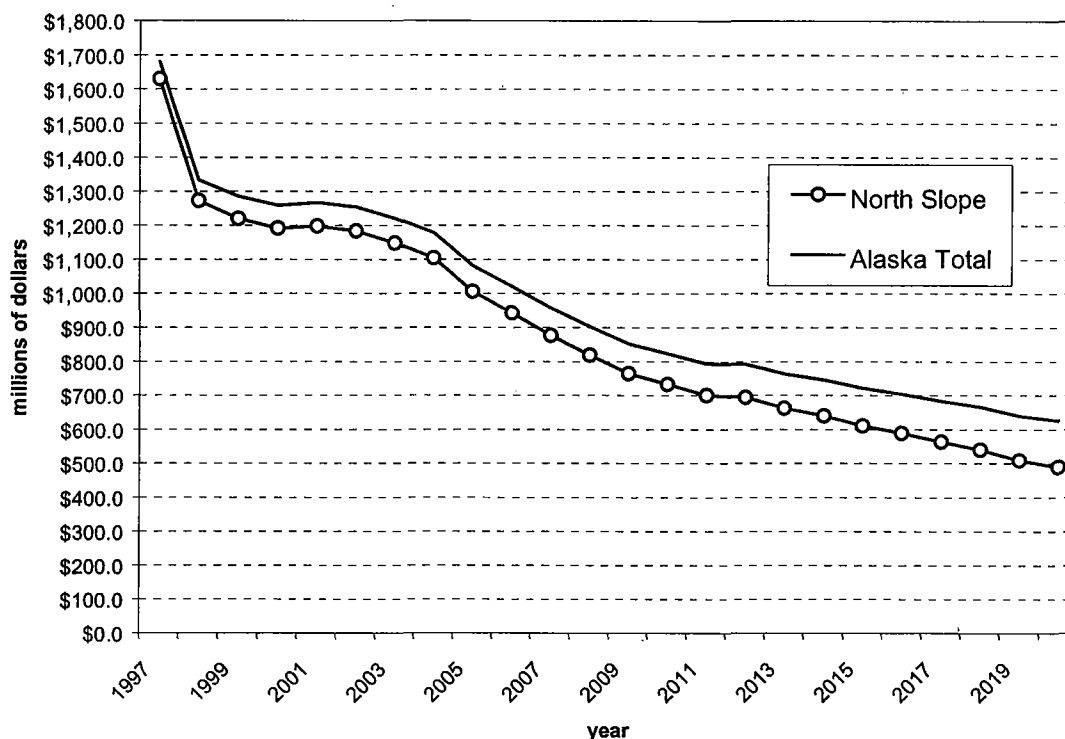
The primary source of state revenues is North Slope oil production. North Slope fields hold 98 percent of the state's known oil reserves and 90 percent of the state's known gas reserves. The remainder of state oil and gas reserves are found in Cook Inlet fields. However, oil and gas reserves are finite resources and North Slope production is declining (see Figure 5.6).

North Slope oil production has declined by approximately 600,000 barrels of oil per day (bpd) from its peak of approximately 2.0 million bpd in 1988 to an average of 1.41 million bpd for fiscal year 1997 (ADOR, 1997:43). The overall decline will accelerate, and production is expected to fall to 1,116 thousand bpd by 2005 and to 431 thousand bpd in 2019 (Beasley, 1998) (See figure 5.7). Annual production from Cook Inlet fields has been declining for many years. Cook Inlet production now averages approximately 32,000 bpd, down from a peak of 227,200 bpd average in 1970 (Beasley, 1998). These declines in oil production cause corresponding decreases in related revenues and seriously impact state government income and spending.

Figure 5.6 Historical Alaska North Slope Crude Oil Production



As a result of the sale, there may be a one-time increase in state income from bonus payments, and an annual increase from rental payments. Given the low to moderate petroleum potential in the sale area (described in Section II), the potential for additional revenue is unknown. ADNDR does not know how many and which Sale 87 tracts will be leased. However, if only 5 percent of the tracts are leased, with a minimum bid of \$5 per acre, the state can expect to receive \$1.75 million in bonus bids. Historically, the amount of bonus bids varies considerably from tract to tract. The average per acre bonus bid in North Slope sales over the last five years has been \$91.46. Using this average under a 5 percent leasing scenario, the state would receive over \$32 million in bonus bids. If 5 percent of tracts offered were to be leased, over the term of these leases (assuming seven years), the state could expect to receive up to \$5.6 million in rental income. This is revenue the state would receive regardless of whether there is any development.

Figure 5.7 Alaska Oil and Gas Severance Tax and Royalty Revenue Forecast**Petroleum Severance Tax and Royalty Revenue Forecast**

2. Effects of Industry Investment

The amount that industry invests depends on the expected return on each dollar invested. Projects in Alaska often compete with projects in other parts of the world for the same investment dollars. The lower the investment dollar per barrel of recoverable reserves, the higher the likelihood that project expenditures will be made. A project's development costs plus the costs of production over the life of the field are estimated and compared to the total volume of recoverable reserves. Some estimate of the price per barrel is selected, and return on investment dollar is calculated by the lessee. If the return rate is high enough, then the project commences, oil or gas is produced, and oil royalties and production taxes are realized.

Investment dollars go into three basic spending categories: labor (including wages and salaries paid to workers and contractors), equipment and supplies, and services. Oil and gas firms contract with other firms for goods and services, some of which can be obtained from Alaska vendors, while others are contracted out of state. Direct expenditures in turn generate other indirect expenditures in the economy.

The number of tracts that will be leased in a particular sale is impossible to predict, because of the competitive nature of the leasing process. Exploration and development expenditure levels vary by project. Expenditure patterns depend on the type of project, such as remote or marginal field development or remote exploration. A remote field development project would spend a higher proportion of total costs on transportation services and road or pad construction. Estimates (used by the Alaska Oil and Gas Policy Council for an input-output model of the state's economy) based on survey data indicate that up to 80 percent of exploration and production expenses are made in-state, while appraisal, remote development, marginal development, and enhanced oil recovery expenditures rely more on out-of-state contractors (AOGPC,

1995:35). For example, if the average cost to drill a well was \$2.5 million, then about two million dollars would likely be spent in-state on that well.

The remote field scenario in the AOGPC study involves an extensive amount of exploration activity. "Historical data indicate that approximately 25 wells would be required to discover a remote field large enough to support the necessary infrastructure and be commercially viable" (AOGPC, 1995:32). Production activities require more services and less construction than exploration and development scenarios. Direct and indirect expenditures by category for typical project scenarios from AOGPC are in Table 5.2.

Table 5.2 Distribution of Direct and Indirect Industry Expenditures

Industry	Remote Field Development	Remote Exploration
Manufacturing	34%	17%
Transportation	10%	6%
Services	20%	16%
Construction & Other	7%	34%
Communication	7%	9%
Trade	10%	8%
Finance, Insurance & Real Estate	12%	11%

From: AOGPC, 1995

3. Effects on Municipal Finance

Under the umbrella of the state constitution, local government is provided the powers of land use zoning and taxation. Although some North Slope Borough funds are derived from revenue sharing programs with the state (see Table 5.3), borough revenues are primarily generated from taxes on residential, commercial, and oil and gas properties. These revenues fund capital improvement projects and community services such as education, public safety, planning, and health care, and allow the borough to employ local residents (see Table 5.4). In 1991, the NSB Assembly was able to repeal the sales tax as a result of an agreement by the major North Slope oil producers to pay the NSB an additional \$5 million per year for five years.

Table 5.3 State Revenues to North Slope Borough communities, FY 96

Municipality	Revenue Sharing	Other State Revenue	Total
North Slope Borough	\$381,977	\$9,673,183	\$10,055,160
Anaktuvuk Pass	31,720	23,820	55,540
Atqasuk	31,720	26,038	57,758
Barrow	110,229	189,865	300,094
Kaktovik	31,720	9,314	41,034
Nuiqsut	31,720	14,086	45,806
Point Hope	25,430	82,832	108,262
Wainwright	31,720	42,068	73,788

Source: ADCRA, 1998

Note: Other state revenues include State Safe Communities program and do not include education funding.

Oil and gas production activities from existing discoveries already comprise a significant percentage of the NSB economy and tax base. Approximately 98 percent of the borough's property taxes come from assessments on the oil industry (ADCRA, 1996a). However, the NSB is dependent on revenue tied to production from oil fields that are in decline. At present, it is facing a non-increasing revenue base. The current assessment of property values related to the oil and gas industry within the borough is approximately \$12 billion, down from a peak value in 1987 of about \$13.5 billion (MMS, 1990:79, 85, 97). This includes the segments of TAPS (containing the first 177 miles of the pipeline, including support facilities) which lie within borough boundaries.

Table 5.4 North Slope Borough Employment Profile

NSB average monthly employment and earnings, 1996.

Industry	Workers	Av. Monthly Earnings
Mining (Oil and Gas)	3,548	\$6,741
Construction	344	\$6,124
Trans/Comm/Utilities	428	\$5,869
Retail Trade	524	\$3,159
Services	890	\$3,080
Federal Government	43	\$3,584
State Government	57	\$4,320
Local Government	2,286	\$3,480
Finance, Insurance, Real Estate	143	*
Total:	8,263	

* Is used to avoid disclosure of data for individual firms.
Source: Alaska Department of Labor, 1997

In preparation for declining tax revenues, the NSB has established a permanent fund. Whenever the borough government's income exceeds expenditures, the surplus is added to the existing fund's investment base. For the fiscal year 1996-97 the value of the fund was approximately \$361 million (NSB, 1997:80). Earnings from investments are earmarked to provide public services. In FY 1996-1997, the fund earned \$48.4 million (NSB, 1997:vi).

Jobs in the NSB rely on government and industry spending. Government employment (federal, state, and local) accounted for 2,386 full time permanent jobs. Next to the oil industry, the NSB is the region's principal employer. Borough employment policies encourage that local residents be hired for borough funded community projects.

As exploration takes place, and if development occurs, the sale would add jobs to the local economy. These jobs would not be limited to the petroleum industry, but would be spread throughout the trade, service, and construction industries. However, the number of jobs produced would depend on whether commercial quantities of oil and gas are discovered and developed. Discovery and development of commercial quantities of petroleum or natural gas in the Sale 87 area would bring direct economic benefits to the local and regional economy.

Local government plays a major role in the health, education, and living standard of village residents, and is the main engine of the cash portion of the economy. This engine is fueled by local taxes and state and federal revenues. The budget for the NSB includes an operating budget and a capital budget.

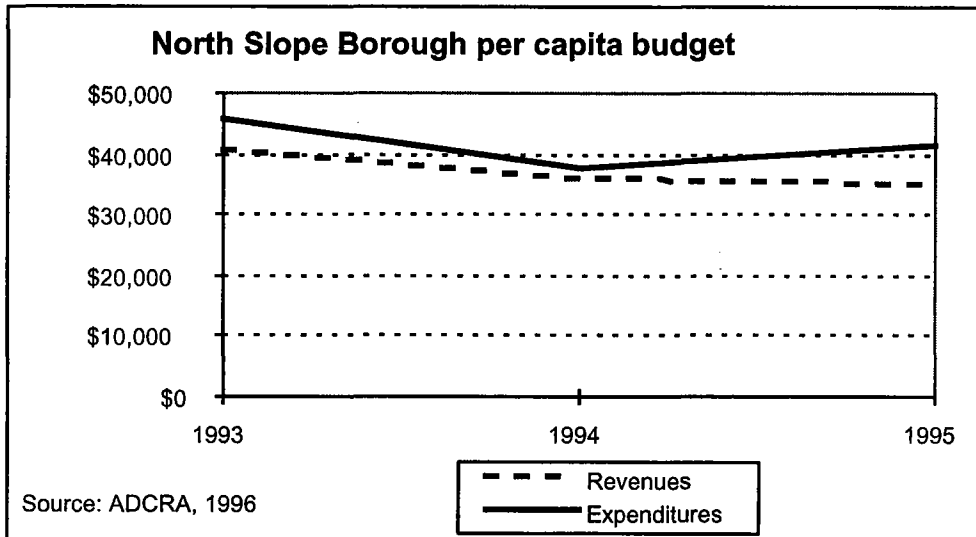
a. NSB Revenues

Local revenues include oil and gas property and other property taxes, license permits, service charges, enterprise revenues, bingo receipts and other local revenues. Service charges may include airport operation contracts, rents on leased property, and oil related service charges. Enterprises include water and sewer systems, washeterias, garbage collection, electric service, cable TV, fuel and gravel sales, and revenues from the Kuparuk Industrial Center, Barrow Gas Fields, and Service Area 10 (ADCRA, 1996b). The Kuparuk Industrial Center was sold in 1997 (NSB, 1997).

State revenues include revenue sharing, municipal assistance, and other revenues. State revenues include operating grants for health and social services, such as suicide prevention, alcoholism treatment, child and senior care programs (ADCRA, 1996b).

In 1995, the NSB derived 77 percent of its operating revenue from oil and gas property taxes (ACRA, 1998)(NSB, 1997), which translated to about \$36,000 in total revenues per capita. Between 1993 and 1996, per capita spending exceeded revenues (See figure below). Revenues to the NSB are expected to decline in the future as existing oil fields, including Prudhoe Bay and Kuparuk are depleted, infrastructure shrinks, and the

value of taxable oil and gas exploration, production, and transportation property declines. In light of this decline, the NSB has launched initiatives to develop new oil and gas resources, diversify its economy and labor force, and reduce dependency on oil dollars (NSB, 1993).



In 1995, only 70 percent of total operating revenue came from oil and gas property taxes; an indication that efforts to diversify are succeeding (ADOR, 1996). Oil and gas lease sales provide the mechanism for economic diversification by generating local revenues, which can be reinvested in self-sustaining enterprises.

In 1996, the assessed value taxable property was \$11.7 billion, representing a decline of \$150 million from the previous year (NSB, 1997). In 1995, property tax revenues for the borough were \$3,753,201, and oil and gas property tax revenues were \$223,520,017, for a total tax revenue of \$227,273,218 (ADCRA, 1998). The borough's 1996 revenues and expenditures are depicted in tables 5.5 and 5.6.

Table 5.5 North Slope Borough Fiscal Year 1996 Revenues

Operating	Local	Local Taxes	\$228,097,544	
		Service Charges	\$10,811,177	
		Enterprises	\$12,499,576	
		Other Local Revenues	\$44,102,601	\$295,510,908
	State	Revenue Sharing	\$381,977	
	Other State Revenue	\$9,674,183	\$10,055,160	
Federal		\$5,000,000	\$5,000,000	
	Other (State and Federal Education Funding)			\$22,898,248
Capital				\$1,790,640
Total				\$335,254,956

Table 5.6 North Slope Borough Fiscal Year 1996 Expenditures

Operating	General Government	Admin & Finance		\$64,030,433	
	Public Safety			\$15,161,325	
	Public Services	Health	\$21,800,288		
		Misc. Pub Services	\$51,374,291		
		Education	\$44,570,282	\$117,744,861	
Debt Retire			\$165,652,305		
Capital				\$126,120,047	
Total				\$488,708,971	

b. NSB Expenditures

Total expenditures in 1996 were \$346 million, 47 percent of which went to debt retirement. Other expenditures went to pay for general government, public safety, housing, wildlife management, health and social services, and municipal services. General government spending includes municipal council, administration and finance, planning and zoning, and other general government expenditures. Public Services include parks and recreation, health care, library and museums, water, sewer, phone, electricity, mass transit, airports, harbors and docks, and ice and gravel roads (NSB, 1997)

c. Capital Projects

In 1995, the borough spent about \$126million on capital projects and more than \$143 million in the following year. The NSB has numerous capital project funds. Capital project spending in FY 1996-1997 included the following:

Table 5.7 North Slope Borough FY 1996-1997 Capital Projects Funds

Fund	Expenditures
Education and Services Center Facilities	\$17,559,712
Public Roads, Watercourse and Flood Control Facilities	11,720,771
Public Housing	15,063,841
Water Facilities	26,800,323
Sewage Treatment Disposal Facilities	19,413,768
Airport and Airport Terminal Facilities	1,689,618
Urban Development Projects	90,141
Light, Power and Heating Systems	21,331,600
Public Safety Facilities	8,559,674
Sanitary Facilities	2,361,768
Communications	441,283
General Capital Projects	2,561,006
Health Facilities	4,443,849
Library/Cultural Facilities	6,873,617
Administration Facilities	4,424,916
TOTAL	\$143,335,887

Source: NSB, 1997

d. Education

The North Slope Borough School District is operated and funded by the borough with state and federal funds and borough funds. Between 1993 and 1995, state and federal funding for education declined 2.3 percent, while borough funding increased 40 percent to cover the loss and pay for an overall increase in education costs of 16.8 percent for that period (ADCRA, 1996b). See table 5.7. In 1996, the NSB spent \$44,570,282 on education, of which \$22,898,248 (51 percent) came from state or federal sources (ADCRA, 1998).

Table 5.8 North Slope Borough Education Costs

	Funding Source		Total
	State and Federal	Local	
1993	\$20,867,142	\$17,184,850	\$38,051,992
1994	\$20,596,946	\$19,294,227	\$39,891,173
1995	\$20,377,720	\$24,071,929	\$44,449,649
1996	\$22,898,248	\$21,672,034	\$44,570,282

Source: ADCRA, 1996b

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Chapter Six: Specific Issues Relating to Oil and Gas Exploration, Development, Production and Transportation

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Chapter Six: Specific Issues Relating to Oil and Gas Exploration, Development, Production and Transportation

A. Geophysical Hazards

The primary geophysical hazards within the Sale 87 area include earthquakes, faulting, shore-ice movement, permafrost and frozen-ground phenomena, waves, coastal erosion, seasonal flooding, overpressured sediments, and shallow gas deposits and hydrates. These geohazards could impose constraints to exploration, production, and transportation activities associated with possible petroleum development, and should be considered prior to the siting, design and construction of any facilities.

1. Faults and Earthquakes

Surface faults¹ have been mapped throughout the Central Beaufort including high-angle faults, basement-involved² normal faults, listric growth faults³, and north-dipping gravity faults⁴. Locally, two or more types may occur in close proximity to each other.

High-angle faults occur along the Barrow Arch extending into Harrison Bay. Along the Barrow Arch⁵ they are related to the basement tectonics of the Arctic Platform⁶ while in Harrison Bay, they offset the Tertiary and older units (See Table 2.2). There has been little evidence of any Quaternary movement, with no evidence of displacement in the Pleistocene or Holocene sediments, and there has been no recent seismicity associated with these faults. Thus, differential movement along these faults seems to have ended prior to the beginning of the Quaternary Period (Craig and Thrasher, 1982).

A number of shallow faults have been mapped north of the Arctic Platform. Included in these faults are the upper extensions of detached listric growth faults that exist deep in the Brookian⁷ section. These faults have been mapped in the greatest detail in the Camden Bay area where some of these faults may have been reactivated in the late Cenozoic and can have several tens of meters of offset. Shallow faults have also been mapped beneath the outer shelf, west of Cape Halkett, and are reported to show from 3 to 10 meters of Quaternary offset (Grantz and others, 1983).

In contrast to the rest of the Beaufort shelf, the Camden Bay area, just east of the sale area, is still seismically active. This region is located at the northern end of a north-northeast trending band of seismicity that extends north from east-central Alaska (Biswas and Gedney, 1979). Since monitoring began in 1978, a large number of earthquakes, ranging from magnitude one to over five, have been recorded in this area, with

¹ A fault is a surface or zone of rock fracture along which there has been displacement, from a few centimeters to a few kilometers in scale (American Geological Institute, Glossary of Geology, 1973).

² The term "basement" refers to the surface beneath which sedimentary rocks are not found (Encyclopedic Dictionary of Exploration Geophysics, 1991).

³ A "listric" surface is a curvilinear, usually concave-upward surface of fracture that curves, at first gently and then more steeply, from a horizontal position. Listric surfaces form wedge-shaped masses, appearing to be thrust against or along each other (American Geological Institute, Glossary of Geology, 1973).

⁴ A gravity fault is a normal fault that shows downward displacement.

⁵ The Barrow arch is a broad structure in the basement rocks that has elevated all successive strata.

⁶ A "platform" refers to that part of a continent which is covered by a flat-lying or gently tilted strata, mainly sedimentary, which are underlain at varying depth by a basement of rocks that were consolidated during earlier deformations (American Geological Institute, Glossary of Geology, 1973).

⁷ The Brookian section began about 100 million years ago and continues into the late Tertiary.

the majority of events clustering along the axis of the Camden anticline⁸. The largest earthquake recorded in the area was a magnitude 5.3 event located 30 km north of Barter Island in 1968. In this region, the Tertiary and Quaternary units dip away from and are truncated at the top of the Camden anticline, indicating that it has been growing in recent geologic time. The faults in this region trend northwest-southeast, parallel to the Hinge Line⁹ and as they approach and intersect the axis of the Camden anticline, they offset progressively younger units. This suggests that these faults are older Hinge Line-related structures that were reactivated during late Tertiary and Quaternary by the uplift of the Camden anticline.

North of the sale area, on the outer Beaufort shelf and upper slope are gravity faults that are related to large rotational slump blocks¹⁰ (Grantz and Dinter, 1980). South of these slumps, which bound the seaward edge of the Beaufort Ramp, these faults have surface offsets ranging from 15 meters to as high as 70 meters (Grantz and others, 1982b). Grantz and others (1982b) have inferred that these faults have been active in recent geologic time based on the age of the faults and therefore pose a hazard to bottom-founded structures in this area. Large-scale gravity slumping of the blocks here could be triggered by shallow-focus earthquakes centered in Camden Bay or in the Brooks Range.

Figure 6.1 shows the locations of recorded earthquake epicenters in the Sale 87 area. Most of the seismicity in the region is shallow (less than 20 miles deep), indicating near-surface faulting. Recent significant events include two magnitude 5 earthquakes in the eastern part of the sale area, one in 1993 and one in 1995. The largest event in the region was a magnitude 5.3 earthquake north of Kaktovik in 1968. (Combellick, 1998)

Algermissen and others (1991) estimate a 10 percent probability of exceeding 0.025 g¹¹ earthquake-generated horizontal acceleration in bedrock during a 50-year period in the eastern part of the sale area. The estimated 10-percent-in-50-year acceleration decreases to 0.01 g in the western part of the area. For comparison, ground acceleration in Anchorage during the great 1964 earthquake was estimated at 0.16 g. In isolated areas throughout the sale area underlain by thick, soft sediments, the ground accelerations are likely to be higher than in bedrock, due to amplification. However, thick permafrost beneath most of the area may cause the earthquake response of sediments to be more like bedrock, which would limit amplification effects and would also tend to prevent earthquake-induced ground failure, such as liquefaction.

It is standard industry practice that facility siting, design, and construction be preceded by site-specific, high-resolution, shallow seismic surveys which reveal the location of potentially hazardous geologic faults. These surveys are required by the state prior to locating a drilling rig. Facility planners are encouraged to consult with the American Petroleum Institute's publication, "Planning, Designing, and Constructing Structures and Pipelines for Arctic Conditions, Second Edition, December 1, 1995." This document contains considerations that are unique for planning, designing, and constructing Arctic systems.

The Sale 87 area lies within seismic zones 0 and 1 of the Uniform Building Code (on a scale of 0 to 4, where 4 represents the highest earthquake hazard), and earthquake potential is low. Regardless, all structures in the Sale 87 area should be built to meet or exceed the Uniform Building Code requirements for zone 1 (Combellick, 1994).

⁸ An "anticline" is a fold, the core of which contains the stratigraphically older rocks; it is convex upward. The opposite is called a syncline (American Geological Institute, Glossary of Geology, 1973).

⁹ Generally, a hinge line refers to a line or boundary between a stable region and a region undergoing upward or downward movement (American Geological Institute, Glossary of Geology, 1973).

¹⁰ A "slump block" is the mass of material torn away as a coherent unit during a block slump. The rotation refers to the apparent fault-block displacement in which the blocks have rotated relative to one another, so that alignment of formerly parallel features is disturbed (American Geological Institute, Glossary of Geology, 1973).

¹¹ Gravitational acceleration. One g equals an acceleration rate of 32 feet per second per second.

Figure 6.1 Recorded earthquake epicenters in the Sale 87 area.

2. Ice Push

Ice push is the process whereby ice blocks are forced onshore by strong wind or currents and push the sediment from the coast into the ridges farther inland. Throughout the Beaufort Sea, ice push and ice override events can transport and erode significant amounts of sediment. It is most important on the outer barrier islands where ice push ridges up to 2.5 meters high, extending 100 meters inland from the beach have been identified (Hopkins and Hartz, 1978). Over most of the Arctic coast, ice push rubble is found at least 20 meters inland with boulders in excess of 1.5 meters in diameter (Kovacs, 1984). A number of accounts of ice push events have been documented where man-made structures have been damaged along the Beaufort coast. In January of 1984, ice over-topped the Kadluck, an eight-meter-high caisson-retained drilling island located in Mackenzie Bay (Kovacs, 1984).

Ice push has the potential to alter shorelines and nearshore bathymetry, which in the longer term may pose a threat to nearshore facilities with increased erosion. Design parameters to mitigate the effects of ice push are similar to those employed to resist sea ice and coastal erosion forces. These include concrete armoring, berm construction, and coastal facility set-backs.

3. On-Shore Permafrost and Frozen Ground

Permafrost exists throughout most of the onshore Beaufort and is for the most part, a relict¹² feature overlain by a thin layer of seasonally frozen sediment. The thickness has been measured from numerous onshore wells indicating that it thins from east to west. East of Oliktok Point, it has been measured to be 500 meters thick, whereas west of the Colville River it has been measured to be 300 to 400 meters thick (Osterkamp and Payne, 1981). The depth of seasonal thaw is generally less than one meter below the surface and two meters beneath the active stream channels. The ice content varies throughout the region from segregated ice to massive ice in the form of wedges and pingos, and is the highest in the fine-grained, organic-rich deposits and the lowest in the coarse granular deposits and bedrock (Collett and others, 1989).

Ground settlement, due to thawing, occurs whenever a heated structure is placed on the ground underlain by shallow, ice-rich permafrost, and the proper engineering measures are not taken to adequately support the structure and prevent the building heat from melting the ground ice. In addition, the seasonal freeze-thaw processes will cause frost jacking of nonheated structures placed on any frost-susceptible soils unless the structures are firmly anchored into the frozen ground with pilings or supported by non-frost-susceptible fill (Combellick, 1994). The frost susceptibility of the ground is highest in fine-grained alluvium, colluvium, thaw-lake deposits, and coastal-plain silts and sands; moderate in alluvial-fan deposits and till; and lowest in coarse-grained flood-plain deposits, alluvial terrace deposits and gravely bedrock (Carter and others, 1986; Ferrians, 1971; Yeend, 1973a, b).

Frozen-ground problems can be mitigated through proper siting, design, and construction, as has been demonstrated at Prudhoe Bay. Structures, such as drill rigs and permanent processing facilities, should be insulated to prevent heat loss into the substrate. Pipelines can be trenched, back-filled, and chilled (if buried) or elevated to prevent undesirable thawing of permafrost.

4. Waves and Coastal Erosion

Wave heights along the Beaufort coastline are low throughout most of the year because of the short fetch resulting from the pervasive ice cover. However, in the fall open-water season, a considerable fetch can develop both seaward and shoreward of the barrier islands. During this time, storm waves can reach up to 7 to 9 meters when the fetch is equal to 800 km and can become effective erosive agents both onshore and along the exposed faces of the barrier islands (Appel, 1996). Also, wind-induced storm surges can force the ice and water onshore and can raise sea level as much as 3 meters, with an additional meter added to this due to low atmospheric pressures associated with the storms (Barnes and Reimnitz, 1974).

¹² A "relict" feature pertains to a mineral, structure, or feature of a rock that represents those of an earlier rock and which persist in spite of processes tending to destroy it (American Geological Institute, Glossary of Geology, 1973).

Even with the short open-water season along the Beaufort coastline, the wave action, in combination with the melting of coastal permafrost, can cause dramatic rates of coastal erosion. Average rates of erosion across the Beaufort coastline range from 1.5 to 4.7 meters per year with short term erosion rates of 30 meters per year. In one case, near Oliktok Point, the coastline eroded 11 meters during one two-week period (Hopkins and Hartz, 1978a).

The highest rates of erosion occur along the coastal promontories where the bluffs are composed of fine-grained sediments and ice lenses. In some areas, beaches have been formed from the gravel eroded from bluffs composed of coarse-grained deposits and act to partially isolate those bluffs from wave action. In other areas, where the bluffs are composed of fine sediment, the sand eroded from the bluffs do not form protective beaches, causing the bluffs to erode more rapidly. In the Harrison Bay area, where the bluffs are composed primarily of coarser grained sediments, the average retreat rates are between 1.5 to 2.5 meters per year (Craig and others, 1985).

The only prograding (advancing) shoreline areas along the Beaufort coastline occur off the deltas of major rivers. In those areas, the rate of progradation is very slow, such as the Colville River, which averages 0.4 meters per year (Reimnitz and others, 1985).

Bank erosion along the rivers in the region is produced through similar processes, where the sediment cohesiveness is a major factor in determining the river bank erodibility. In this case, the higher erosion rates occur along the braided channels, which usually develop in areas composed of noncohesive sediment (Scott, 1978). In a study along the Sagavanirktok River, aerial photographs showed a maximum erosion rate of 4.5 meters per year during a 20-year period. In this area, most of the erosion appeared to occur in small increments during breakup flooding and was concentrated in specific areas where conditions were favorable for thermo-erosional niching (Combellick, 1994).

Erosion rates, sediment grain size and cohesiveness, river bank stability, and nearshore bathymetry must all be considered in determining facility siting, design, construction, and operation. They must also be considered in determining the optimum oil and gas transportation mode. Structural failure can be avoided by proper facility set-backs from coasts and river banks. Mitigation measure 21 prohibits the siting of permanent facilities, other than road and pipeline crossings, within one-half mile of the banks of the main channel of the Colville, Kuparuk, Sagavanirktok, Shavirovik, Kadleroshilik, Kavik, Echooka, Ivishak, Toolik, Anaktuvuk, Chandler and Canning Rivers. Docks and road or pipeline crossings can be fortified with concrete armor, and the placing of retainer blocks and concrete-filled bags in areas subject to high erosion rates, such as at the Endicott causeway breaches. Mitigation measure 10b prohibits the siting of causeways or docks within river mouths or deltas.

5. Seasonal Flooding

Floods occur annually along most of the rivers and many of the adjacent low terraces due to the seasonal snow melt and ice jamming (Rawlinson, 1993). As the weather warms up, during the spring runoff, the river flood waters inundate the landfast sea ice. At this time of year, large areas of the fast ice are covered with water to depths of up to 1.5 meters, as far as 30 km from the river mouths. When the flood water reaches openings in the ice, it rushes through with enough force to scour the bottom to depths of several meters by the process called strudel scouring (Reimnitz and others, 1974).

In addition to the seasonal flooding, many of the rivers along the coast are subject to seasonal icing prior to the spring thaw. This is due to the overflow of the stream or ground water under pressure, and in the areas of repeated overflow, the residual ice sheets often become thick enough to extend beyond the flood-plain margin. These large overflows and residual ice sheets have been documented on the Sagavanirktok, Shavirovik, Kavik, and Canning Rivers (Dean, 1984; Combellick, 1994).

Storm surges along the Beaufort coast frequently occur in the summer and fall. Sea-level increases of 1 to 3 meters have been observed, with the largest increases occurring on the westward-facing shores. Storm surges can also occur from December through February, although the sea-level elevation changes are generally less than in summer and fall. Decreases in the elevation of the sea-level can occur and occur more frequently during the winter months (MMS, 1995).

Seasonal flooding of lowlands and river channels is extensive along major rivers that drain into the Sale 87 area. Thus, measures must be taken prior to facility construction and field development to prevent losses and environmental damage. Pre-development planning should include hydrologic and hydraulic surveys of spring break-up activity as well as flood-frequency analyses. Data should be collected on water levels, ice floe direction and thickness, discharge volume and velocity, and suspended and bedload sediment measurements for analysis. Also, historical flooding observations should be incorporated into a geophysical hazard risk assessment. All inactive channels of a river must be analyzed for their potential for reflooding. Containment dikes and berms may be necessary to reduce the risk of flood waters that may undermine facility integrity. Mitigation measure 23, discussed in Waves and Coastal Erosion addresses seasonal flooding concerns.

6. Overpressured Sediments

Along the central Beaufort region, extremely high pore pressures can be expected to be found where Cenozoic strata (sedimentary layers) are very thick, such as in the Kaktovik, Camden, and Nuwuk Basins. Onshore, in the Camden Basin, high pore pressures have been measured in both the Tertiary and Cretaceous formations where the burial depths of the Tertiary strata exceeded 3,000 meters (Craig and others, 1985).

In the Point Thomson area, the pore pressure gradients were measured as high as 0.8 pounds per square inch per foot (psi/ft) in sediments at burial depths of 4,000 meters. In this area a pore pressure gradient of 0.433 psi/ft is considered normal (Hawkings and others, 1976). High pore pressures have also been measured throughout the Cenozoic strata of the Mackenzie Delta in the Canadian Beaufort. Here, the pore-pressure gradients were measured as high as 0.76 psi/ft and have been observed at depths as shallow as 1,900 meters (Hawkings and others, 1976).

Drilling mud in the well-bore is mixed to a specific density that will equal or slightly exceed the pressure in the formation. When formation pressures exceed the weight of the drill mud in the well-bore, the result can be a kick¹³ or blow-out. Thus, encountering over-pressured sediments while drilling can result in a blow-out or uncontrolled flow. The risk of a blow-out is reduced by identifying locations of overpressured sediments via seismic data analysis, and then adjusting the mud mixture accordingly as the well is drilled. If a kick occurs, secondary well control methods are employed. The well is shut-in using the blow-out prevention (BOP) equipment installed on the wellhead after surface casing is set. The BOP equipment closes off and contains fluid pressures in the annulus and the drillpipe. BOP equipment is required for all wells and surface and sub-surface safety valves are required to automatically shut-off flow to the surface.

7. Shallow Gas Deposits and Natural Gas Hydrates

Shallow pockets of natural gas have been encountered in boreholes throughout the Arctic, both onshore and offshore. This gas usually exists in association with faults that cut Brookian strata, and as isolated concentrations in the Pleistocene coastal plain sediments (Granz and others, 1982b). The presence of shallow gas has been inferred from studies by Boucher and others (1980), Craig and Thrasher (1982), Sellmann and others (1981), and Grantz and others (1982b). Sediments in which gas has accumulated are a potential hazard if penetrated during drilling as well as for any manmade structures on top of them.

Natural gas hydrates commonly occur offshore under low-temperature, high-pressure conditions (Macleod, 1982) as well as at shallower depths associated with permafrost (Kvenvolden and McMenamin, 1980). In the central Beaufort, gas hydrates have been found at shallow depths under permafrost along the inner shelf (Sellmann and others, 1981) as well as onshore at Prudhoe Bay (Kvenvolden and McMenamin, 1980). During drilling, the rapid decomposition of gas hydrates can cause a rapid increase in the pressure in the wellbore, gasification of the drilling mud, and the possible loss of well control. If the release of the hydrate gas is too rapid, a blowout can occur, and the escaping gas could be ignited. In addition, the flow of hot hydrocarbons past a hydrate layer could result in hydrate decomposition around the wellbore and the loss of strength of the affected sediments. If this happened and the well were shut-in for a period, the reformation of the hydrates could induce high pressures on the casing string (MMS, 1995).

¹³ A kick is a condition where the formation fluid pressure (pressure exerted by fluids in a formation) exceeds the hydrostatic pressure (pressure exerted by mud in the borehole) resulting in a "kick"; formation fluids enter the borehole.

Because gas hydrates and shallow gas deposits pose risks similar to overpressured sediments, the same mechanisms for blow-out prevention and well control are employed to reduce the danger of loss of life or damage to the environment. For more detail on oil spills and their effects, see Chapter Five. For a discussion of oil spill prevention and response, see Section C of this chapter.

B. Likely Methods of Transportation

If commercial quantities of oil are found in the Sale 87 area, it will go to market via the Trans-Alaska Pipeline System (TAPS), a 798-mile pipeline from Prudhoe Bay to Valdez. From Valdez, the oil is transported to markets in Cook Inlet, the U. S. West Coast, and the U. S. Gulf Coast via tanker. In-field gathering lines bring the oil from individual well sites to processing facilities for injection into TAPS.

Buried or elevated pipelines are the only feasible means for transporting oil and gas from developed fields to TAPS. The advantages and disadvantages of two options are set forth below. It is possible that a transportation system used for oil or gas from the Sale 87 area will be based upon both options. The mode of transport from a discovery will be an important factor in determining whether or not future discoveries can be economically produced. Buried pipelines are more expensive to install and maintain than elevated pipelines. The more expensive a given transportation option is, the larger a discovery will have to be to be economically viable.

1. Elevated Pipelines

Elevated pipelines are typically used in North Slope oil field development to prevent heat transfer from the hot oil in the pipeline to frozen soils, since heat would degrade the permafrost. Elevated pipelines are easy to maintain and visually inspect for leaks. However, above-ground pipelines can restrict caribou and other wildlife movements unless provisions are made to allow for their safe passage. For the Alpine development project, ARCO may gradually increase the standard five foot minimum to accommodate undulating terrain, thus minimizing vertical bends in the pipeline. To further enhance caribou and human crossing, selected portions of the elevated pipeline may be elevated 7 to 8 feet near streams and lakes where caribou and human use are high (Parametrix Inc., 1996:2-8).

There appears to be a cumulative effect of roads and adjacent pipelines that creates a barrier to caribou crossing. Pipelines elevated at least five feet have been shown to be effective except when they were in proximity to roads with moderate to heavy traffic (15 or more vehicles/hour). Roads with low levels of traffic and no adjacent parallel pipeline are not significant barriers to movement of caribou. The Alaska Caribou Steering Committee concludes the most effective mitigation is achieved when pipelines and roads are separated by at least 500 feet. Lessees are encouraged (Lease Advisory 10) in planning and design activities to consider the recommendations for oil field design and operations contained in the final report of the Alaska Caribou Steering Committee (Cronin et al., 1994:10).

2. Buried Pipelines

Buried pipelines are feasible in the Arctic provided that the integrity of the frozen soils is maintained. Such pipeline configurations have been used in the Milne Point area. There are some important considerations regarding long sections of buried pipe. First is cost, which depends on length, topography, soils, and distance from the gravel mine site to the pipeline. Second, buried pipe is more difficult to monitor and maintain. However, significant technological advances in leak detection systems have been made which increase the ease with which buried pipelines can be monitored. These systems are described under the oil spill prevention subsection in Chapter Six. Third, buried pipelines may involve increased loss of wetlands because of gravel fill. Finally, buried pipelines are sometimes not feasible from an engineering standpoint because of the thermal stability of fill and underlying substrate (Cronin et al., 1994:10).

For its Alpine development project, ARCO is planning a buried oil pipeline under the Colville River. The pipeline will be installed at a depth of approximately 50 feet or greater beneath the river bed using horizontal directional drilling methods (Parametrix Inc., 1996:2-12). The pipeline will be insulated and operated such that the oil temperature will ensure that thaw settlement will be within tolerable limits. The leak detection system will employ real-time monitoring supplemented by the use of inspection pigs (ARCO,

1996:6-9). The Colville River pipeline will be designed for a minimum service life of 20 years (ARCO, 1996:6).

3. Mitigation Measures

Any crude oil ultimately produced from Sale 87 tracts will have to be transported to market. It is important to note that the decision to lease oil and gas resources in the state does not authorize the transportation of any oil. If and when oil is found in commercial quantities and production of oil is proposed, final decisions on transporting that oil will be made through the local, state, and federal permitting process. That process will consider any required changes in oil spill contingency planning and other environmental safeguards.

No oil or gas will be transported from the Sale 87 leases until the lessee has obtained the necessary permits and authorizations from federal, state, and local governments. The state has broad authority to withhold, restrict, and condition its approval of transportation facilities. In addition, both the North Slope Borough and the federal government have jurisdiction over various aspects of any transportation alternative. Mitigation measures and lease advisories (listed in Chapter Seven) that mitigate any potential impacts of the selected transportation mode are:

- Measure 7a requires that pipelines be located so as to facilitate the containment and cleanup of spilled hydrocarbons.
- Mitigation Measure 7b requires that pipelines be designed and built to provide adequate protection from geophysical and other hazards.
- Mitigation Measure 8 requires that pipelines be designed and constructed to avoid significant alteration of caribou and other large ungulate movement and migration patterns.
- Mitigation Measure 10 pertains to the maintenance of nearshore oceanographic circulation patterns and fish passage. The state of Alaska discourages the use of continuous-fill causeways. Environmentally preferred alternatives for field development include use of buried pipelines, onshore directional drilling, or elevated structures. Causeways, docks, and other structures may be permitted if the Director, in consultation with ADF&G and ADEC, determines that a causeway or other structures are necessary for field development and that no feasible and prudent alternatives exist. Approved causeways must be designed, sited, and constructed to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics (e.g., salinity, temperature, suspended sediments), and must maintain free passage of marine and anadromous fish. Monitoring programs and mitigation, such as breaching, may be required to achieve intended protection objectives.

C. Oil Spill Risk, Prevention and Response

1. Oil Spill History and Risk

Any time crude oil or petroleum products are handled, there is a risk that a spill might occur. Oil spills associated with the exploration, development, production, storage and transportation of crude oil may occur from well blowouts or pipeline or tanker accidents. Petroleum activities may also generate chronic low volume spills involving fuels and other petroleum products associated with normal operation of drilling rigs, vessels and other facilities for gathering, processing, loading, and storing of crude oil. Spills may also be associated with the transportation of refined products to provide fuel for generators, marine vessels and other vehicles used in exploration and development activities. A worst case oil discharge from an exploration facility, production facility, pipeline or storage facility is restricted by the maximum tank or vessel storage capacity or by a well's ability to produce oil. Companies do not store large volumes of crude at their facilities on the North Slope. Produced oil is processed and piped out as quickly as possible. This reduces the possible size of a potential spill on the North Slope.

A well can only spill as much oil as it can produce without assistance. For example, a well with a production rate of 2,500 bbl per day can only spill a maximum of 2,500 bbl per day (Powers 1980:2). A review of the February 1997 production statistics indicates that the average production rate is 1,511 bpd for producing North Slope fields. Some wells cannot produce without mechanical assistance, and if an accident occurs, oil ceases to flow.

a. Exploration and Production

Spills related to petroleum exploration and production must be distinguished from those related to transportation because the phases have different risk factors and spill histories. Exploration and production facilities in the Sale 87 area may include onshore gravel pads; drill rigs; pipelines; and facilities for gathering, processing, storage and moving oil. These facilities are discussed below. When spills occur at these facilities, they are usually related to everyday operations such as fuel transfers. Cataclysmic spills are rare at the exploration and production stages because spill sizes are limited by production rates and by the amount of crude stored at the exploration or production facility.

The most dramatic form of spill can occur during a well blowout which can take place when high pressure gas is encountered in the well and sufficient precautions, such as increasing the weight of the drilling mud, are not effective. The result is that oil, gas, or mud is suddenly and violently expelled from the well bore, followed by uncontrolled flow from the well. Blowout preventers, which immediately close off the open well to prevent or minimize any discharges, are required for all drilling and work-over rigs and are routinely inspected by the AOGCC.

A blowout that results in an oil spill is extremely rare and has never occurred in Alaska. However natural gas blowouts have occurred. An example of a gas blowout occurred in 1992 at the Cirque No. 1 well. The accident occurred while ARCO workers were drilling an exploratory well and hit a shallow zone of natural gas. Drilling mud spewed from the well and natural gas escaped. It took two weeks to plug the well (Anchorage Times, 1992). In 1994, a gas kick occurred at the Endicott field 1-53 well. BP Exploration was forced to evacuate personnel and shut down most wells on the main production island. No oil was released to the surface, as the well had not yet reached an oil-bearing zone. There were no injuries, and the well was killed three days later by pumping heavily weighted drilling muds into it (Schmitz, 1994; Anchorage Daily News, 1994a).

b. Pipelines

The pipeline system that carries North Slope crude from the development area includes gathering lines and pipelines which carry the crude to treatment facilities and to Pump Station 1 where the oil enters TAPS for transport to the port of Valdez. Pipelines vary in size, length and amount of oil contained. A 14-inch pipeline can store about 1,000 bbl per mile of pipeline length. Under static conditions, if oil were lost from a five mile stretch of this pipeline (a hypothetical distance between emergency block valves), a maximum of 5,000 bbl of oil could be discharged if the entire volume of oil in the segment drained from the pipeline.

In January 1994, a pipeline break occurred at a Prudhoe Bay drill site. Investigation showed the failure of the line was caused by wind-induced vibration and the automatic safety valve and alarm had been turned off. Response to the oil spill was swift in containment and cleanup. Most of the oil flowed into an impoundment area and approximately 360 bbl were recovered of an estimated 300-400 bbls spilled. Further investigation found four other wells in the Prudhoe Bay eastern operating area with safety valves turned off (Alaska Journal of Commerce, 1994:4, and Schmitz, 1994). A leak in a Kuparuk pipeline carrying oil to a processing facility was also discovered in 1994. The cause of the two-foot crack in the line has not yet been determined (Schmitz, 1994). The oil flow was shut off and the line depressurized. The breached pipeline carries around 20,000 bbl per day from two drilling sites. About 6,000 square feet of surrounding tundra was affected, but there was no danger to the nearby Ugnuravik River (Anchorage Daily News, 1994:D).

On April 20, 1996 Alyeska Pipeline Company discovered crude oil in an access vault (similar to a manhole) near check valve 92 which is located about 90 miles north of Glennallen. Alyeska and the Joint Pipeline Office (JPO) activated the Incident Command System and dispatched staff to the site and to the emergency operations control center at Alyeska's Anchorage offices. Throughput in the TAPS was reduced from 1.5 million to 850,000 barrels per day during the response. The leak came from a faulty plug on a six-inch bypass line. Check valve 92 is buried about 16 feet below the surface. Alyeska drilled two holes downhill from the valve and removed dirt from around the line in an effort to locate the source of the leak and to determine the extent of impact. The company completed repairs April 25 and recovered about 500 gallons of crude oil from two metal culverts and contaminated soils. (ADEC, 1996)

c. Marine Terminals

There are no marine terminals on the North Slope due to the presence of ice for most of the year. The Valdez terminal receives North Slope crude through TAPS, stores it and loads it onto tanker vessels for transport to the west coast of the United States, Cook Inlet and Pacific Rim. Most North Slope crude is transported to the U.S. west coast. Some North Slope crude is shipped to the Nikiski refinery in Cook Inlet and passes through the Nikiski terminal facility.

The Valdez terminal has maintained records of all spills since startup in 1977. From June 1977 to November 1994, there have been 48 spills greater than 55 gallons from terminal equipment or systems. Of these spills 34 (70 percent) were to land, 10 incidences (20 percent) were to water, and 4 (8 percent) were to both land and water. The causes have been personnel error and equipment failure or unknown. Twenty-six (42 percent) of the spills were North Slope crude, 19 (38 percent) were diesel fuel or lubricants, and 8 (11 percent) were chemicals and water. (Alyeska Pipeline Service Co. 1996)

Petroleum hydrocarbons may enter Port Valdez harbor from ballast water that is off-loaded from incoming tankers. The water is treated to remove residual petroleum hydrocarbons and then discharged via a submarine diffuser into the inlet (Jarvella 1987:582). A four year, pre- and post-operational study undertaken by the University of Alaska (Jarvella 1987, citing Colonell 1980) concluded that no adverse effects on the fjord were presently evident (Jarvella 1987:582). Monitoring continues under National Pollutant Discharge Elimination System (NPDES) permits.

The stationary nature of exploration, production and terminal facilities and the predictability of maximum spill rates based on production rates and storage amounts somewhat simplifies the development and implementation of oil spill contingency plans for those facilities. In contrast, the mobile nature of tankers, the large volumes carried and the exposure to marine hazards places tankers at higher risk for oil spills. A badly damaged tanker can spill millions of gallons of oil in a matter of hours.

d. Tanker Vessels

North Slope crude oil is carried from the Port of Valdez to the U.S. west coast and to the Nikiski refinery in Cook Inlet. Worldwide statistics (excluding the Russian Federation) confirm that tankers, rather than exploration and production activities, present the largest potential for oil pollution. Since the 1980's, a fairly constant rate of 1.3 spills per billion barrels of oil transported has been shown (Anderson, et al., 1992). Current spill rates for single hull tankers are considerably higher than for pipelines. A tanker accident can result in the release of large quantities of oil in a short time, causing severe environmental damage. An oil spill in a marine water setting is also much more difficult to contain than one on land since ocean currents and tidal actions carry the oil over a much larger area.

Tankers heading south out of Hinchinbrook Entrance stay 50 to 200 miles offshore, depending on each company's route and sea and ice conditions. The U. S. Coast Guard does not establish the route. Since November 1994, new USCG safety regulations for tankers operating in the Prince William Sound area, especially through the Valdez Narrows, require tankers to add a third tugboat to accompany tankers when winds exceed 20 knots instead of 30 knots. Shippers voluntarily reduced tanker speed through the Narrows from 6 knots to 5 knots to enable a tugboat attached to the back of a tanker to guide the tanker more effectively.

An independent risk assessment study of oil tankers traversing Prince William Sound concludes that current safeguards instituted after the Exxon Valdez oil spill have significantly reduced the risks of oil spills. The study recommended a number of additional improvements to further reduce risk, and the TAPS shippers are instituting many new safeguards. The shippers are working with Alyeska to:

- Charter a high-powered tug for deployment at Cape Hinchinbrook to reduce the risk of a tanker grounding;
- Upgrade the current fleet of tugs with at least two newly enhanced tugs, incorporating risk assessment recommendations and the state's new "best available technology" regulations;
- Revise tug operating procedures for Valdez Narrows to minimize dangers of human error identified in the risk assessment;

- Work with the U.S. Guard and ADEC to implement a new escort system using prepositioned tugs in central Prince William Sound to reduce the risk of a collision;
- Test new tractor tugs for use in Valdez Narrows; and
- Place new tractor tugs in service as soon as possible if their performance is equal to or better than the tethered-tug system currently in use.

The State, U.S. Coast Guard, and the oil industry have started a safety program to reduce the risks of collisions between fishing vessels and oil tankers. (Oil Spill Intelligence Report, 1996)

During the summer of 1987, the tanker *Glacier Bay* spilled between 2,350-3,800 bbl of North Slope crude oil being transported into Cook Inlet for processing at the Nikiski Refinery (ADEC, 1988:1). Less than ten percent of the oil was recovered, and the spill interrupted commercial fishing activities in the vicinity of Kalgin Island during the peak of the red salmon run. Although not on the scale of the *Exxon Valdez* spill, this spill focused attention on oil spill response and cleanup capabilities in Cook Inlet.

An example of the potential magnitude of a tanker spill is the March 1989 *Exxon Valdez* spill, the largest recorded spill in U.S. waters (nearly 261,900 bbl). Oil from the *Exxon Valdez* contaminated fishing gear, fish, and shellfish, killed numerous marine birds and mammals, and led to the closure or disruption of many Prince William Sound, Cook Inlet, Kodiak, and Chignik fisheries (Alaska Office of the Governor 1989 "Exxon Valdez Oil Spill Information Packet"). Effects of the oil spill on fish and other wildlife can be found in this finding in the section entitled Cumulative Effects.

The spills from the *Glacier Bay* and the *Exxon Valdez* were not effectively contained, and the effectiveness of the cleanup efforts remains the subject of controversy. In the case of the *Glacier Bay* spill in Cook Inlet, tidal currents and confusion concerning who would respond to the spill caused response problems. During the *Exxon Valdez* spill in Prince William Sound, the sheer size of the spill quickly overtaxed available cleanup resources at a time when response plans had not been updated or practiced and equipment stockpiles were not sufficient nor easily accessible.

In May 1994, a cracked hull in the *Eastern Lion* allowed approximately 8,400 gallons of crude oil to leak into the port of Valdez while the vessel was berthed at the marine terminal. As a result of analyzing response methods, Alyeska Pipeline purchased shallow draft boats to allow access of tow boom to the shallow duck flats area and a new ramp is to be built at the fish hatchery to move booms more efficiently from shore to water (Alaska Journal of Commerce, 1994a).

The *Glacier Bay* and *Exxon Valdez* incidents demonstrated that preventing catastrophic tanker spills is easier than cleaning them up and focused public, agency, and legislative attention on the prevention and cleanup of oil spills. Numerous changes were made on both the federal and state levels. At the state level, new statutes created the oil and hazardous substance spill response fund (AS 46.08.010), established the Spill Preparedness and Response (SPAR) Division of ADEC (AS 46.08.100), and increased financial responsibility requirements for tankers or barges carrying crude oil up to a maximum of \$100 million (AS 46.04.040(c)(1)). The discussion of regulations and laws regarding oil spills is presented later in this section.

2. Oil Spill Prevention

A number of measures contribute to the prevention of oil spills during the exploration, development, production, and transportation of crude oil. Some of these prevention measures are presented as mitigation measures in Chapter Four, and some are discussed at the beginning of this section. Prevention measures are also described in the oil discharge prevention and contingency plans that the industry must prepare prior to beginning operations. Thorough training, well-maintained equipment and routine surveillance are important components of oil spill prevention.

a. Exploration and Production:

The oil industry employs many techniques and operating procedures to help reduce the possibility of spilling oil. The techniques that may be used during exploration include:

- Use of existing facilities and roads.
- Waterbody protection, including proper location of onshore oil storage and fuel transfer areas.

- Use of proper fuel transfer procedures.
- Use of secondary containment, such as impermeable liners and dikes.
- Proper management of oils, waste oils, and other hazardous materials to prevent ingestion by bears and other wildlife.

Should development occur, additional measures include:

- Consolidation of facilities.
- Placement of facilities away from fishbearing streams and critical habitats.
- Siting pipelines to facilitate spilled oil containment and cleanup.
- Installation of pipeline leak detection and shutoff devices.

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

Wells are drilled according to the detailed plan. Drilling mud and well pressures are continuously monitored, and the mud is adjusted to meet the actual wellbore pressures. The weight of the mud is the primary well control system. If a kick (sudden increase in well pressure) occurs, the well is shut-in using the BOP equipment. The BOP closes off and contains fluids and pressures in the annulus and in the drillpipe. Technicians take pressure readings and adjust the weight of the drilling mud to compensate for the increased pressure. BOP drills are performed routinely with all crews to ensure wells are shut-in quickly and properly. Rig foremen, tool pushers, drillers, derrick men and mud men all have certified training in well control that is renewed annually. (BP, 1996)

If well control is lost and there is an uncontrolled flow of fluids at the surface, a well control plan is devised. The plan may include instituting additional surface control measures, igniting the blowout, or drilling a relief well. Regaining control at the surface is faster than drilling a relief well and has a high success rate. A blowout may bridge naturally due to the pressure drop across the formations. Under these conditions, reservoir formations flow to equalize pressure and the resulting bridging results in decreased flow at the surface. The exact mechanical surface control methods used depend on the individual situation. Operators may pump mud or cement down the well to kill it; replace failed equipment, remove part of the BOP stack and install a master valve; or divert the flow and install remotely-operated well control equipment. (BP, 1996)

At the same time operators are considering mechanical surface control methods, they begin planning to drill a relief well. They assess the situation and determine the location for the relief well and plan the logistics necessary to move another drill rig to the site. Conditions may require the construction of an ice or gravel pad and road. The operator will look for the closest appropriate drill rig. If the rig is in use, industry practice dictates that, when requested, the operator will release the rig for emergency use. Arranging for and drilling a relief well could take from 10 to 15 weeks depending on weather, cause of the blowout, choice of surface location and depth of the well. (BP, 1996)

Leak detection systems and effective emergency shut-down equipment and procedures are essential in preventing discharges of oil from any pipeline which might be constructed in the sale area. 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. The number and spacing of the block valves along the pipeline will depend on the size of the pipeline and the expected throughput rate (Nessim and Jordan, 1986:68). Industry on the North Slope currently uses the volume balancing method. This method involves comparing input volume to output volume.

The technology for monitoring pipelines is continually improving. Leak detection methods being researched outside Alaska include acoustic monitoring, pressure point analysis, and combinations of some or all of the different methods (Yoon, Mensik, and Luk 1988). The approximate location of a leak can be determined from the sensors along the pipeline. A computer network is used to monitor the sensors and signal any abnormal responses. In recent years, computer based leak detection through a Real-Time Transient Model

to minimize spills has come into use. This technology can minimize spills from both new and old pipelines (Yoon and Mensik, 1988).

A similar technology for detecting leaks in oil and gas pipelines is termed Pressure Point Analysis (PPA). The method uses measured changes in the pressure and velocity of the fluid flowing in a pipeline to detect and locate leaks. PPA has successfully detected holes as small as 1/8-inch in diameter within a few seconds to a few minutes following a rupture (Farmer, 1989:23). Automated leak detection systems such as PPA operate 24 hours per day and can be installed at remote sites. Information from the sensors can be transmitted by radio, microwave, or over a hard wire system.

Design and use of "smart pigs," data collection devices that are run through the pipeline while it is in operation, has greatly enhanced the ability of a pipeline operator to detect internal and external corrosion and differential pipe settlement in pipelines. These pigs can be sent through the pipeline on a regular schedule to detect changes over time and give advance warning of any potential problems. The TAPS operation has pioneered this effort for Arctic pipelines. The technique is now available for use worldwide and represents a major tool for use in preventing pipeline failures.

If pipelines are used in the development of the Sale 87 area, operators would follow the appropriate American Petroleum Institute recommended practices. They would inspect the pipelines regularly to determine if any damage was occurring and would also receive regular maintenance. Preventive maintenance includes installing improved cathodic protection, using corrosion inhibitors and continuing regular visual inspections.

b. Marine Terminals

The fixed location of loading facilities at marine terminals improves oil spill response and contingency planning. If a leak occurs, the facility can be rapidly shut down and the spill contained. Spill prevention measures include extensive inspection programs, monitoring of transfer operations, use of proper valves, overfill alarms, construction of secondary and tertiary containment systems around the tanks, facility security programs, training, and drug and alcohol testing of personnel. More detailed information regarding these programs are included in the oil discharge prevention and contingency plans for Alyeska's Valdez terminal and Kenai Pipe Line Company's Nikiski terminal.

c. Tanker Vessels:

Tankers are the most cost effective and the only feasible method for transporting crude oil from Alaska to destinations in the Pacific Rim. Federal legislation through OPA 90 requires the phase-out of single-hulled tankers in favor of double-hulled tankers by the year 2010. Double-bottomed tankers, where at least 30 percent of the area beneath the cargo tank length has two bottoms, are an approved interim measure.

Several of the tankers transiting Prince William Sound are double-hulled, and OPA 90 requires tankers in Prince William Sound to be accompanied by two escort vessels to Hinchinbrook Entrance. Escort tugs are to keep tanker vessels off the rocks should the tanker lose power. Alyeska Pipeline Company's response organization, SERVVS, maintains five escort response vessels and four tug escort vessels for this purpose. As a result of a recent risk assessment, a high-power escort tug will be stationed at Hinchinbrook. (Lisiechki, 1997) See the discussion on Oil Spill History and Risk for additional details regarding risk-reduction actions in Prince William Sound.

Tesoro contracts for two double-bottomed tankers, the *Chesapeake Trader* and the *Potomac Trader* to bring North Slope crude from Valdez to the Nikiski complex in Cook Inlet for refining. The vessels are hydrostatically loaded, in which tankers are only partially filled with crude so that if a tank were breached, the difference in pressure would cause sea water to flow in rather than the oil to flow out. Other features that may reduce the risk of oil spills during transport include on-deck cargo piping, inert gas system for all cargo tanks, approved vapor recovery systems for use during cargo transfer, and emergency towing packages at the bow and stern.

Many carriers voluntarily follow various other practices that also reduce the risk of oil spills. These practices may include having two licensed officers or one licensed officer and one licensed marine pilot on deck at all times, keeping anchors ready for emergency use when traversing high risk areas, plotting fixes

frequently, conducting unscheduled anchoring drills in the lower inlet, performing regular maintenance procedures and special inspections in preparation for the winter climate, and incorporating special adaptations for tanker use in severe winter conditions.

All tanker crews participate in spill prevention and response training and substance abuse testing. The oil discharge prevention and contingency plans for Alyeska's and Tesoro's vessel operations contain more detailed information regarding spill prevention programs.

3. Oil Spill Response

a. Incident Command System (ICS)

The ICS system is designed to organize and manage responses to incidents involving a number of interested parties in a variety of activities. Since oil spills usually involve multiple jurisdictions, the joint federal/state response contingency plan incorporates a unified command structure in the oil and hazardous substance discharge ICS. The unified command usually consists of the Federal On-Scene Coordinator, the State On-Scene Coordinator, the Local On-Scene Coordinator and the Responsible Party On-Scene Coordinator. Industry and agency personnel in the operations, logistics, planning and finance sections of the incident command system gather information and make recommendations on objectives and strategies to the unified command. A Multi-Agency Coordination group made up of government agencies with local jurisdiction and other concerned parties may also provide input to the unified command. (ADEC, 1994)

The Unified Command jointly makes decisions on objectives and response strategies. However, only one Incident Commander is in charge of the spill response. The Incident Commander is responsible for implementing these objectives and response strategies (AS 46.04.200(b)(2) and (3)). The Responsible Party Incident Commander may remain in charge until or unless the Federal On-Scene Coordinator and the State On-Scene Coordinator decide that the Responsible Party is not doing an adequate job of response. (ADEC, 1994)

b. Response Teams

The Alaska Regional Response Team (ARRT) monitors the actions of the Responsible Party. The Team is composed of representatives from 15 federal agencies and one representative agency from the state. The ARRT is co-chaired by the U.S. Coast Guard and Environmental Protection Agency. ADEC represents the state of Alaska. The team provides coordinated federal and state response policies to guide the Federal On-Scene Coordinator in responding effectively to spill incidents. The ARRT has developed guidelines regarding wildlife, in situ burning, and the use of dispersants. A working group is developing guidelines for the protection of cultural resources, which include archaeological and historic sites. (ADEC, 1994)

Each North Slope operator identifies a spill response team (SRT) for their facility, and each facility must have an approved spill contingency plan. Company teams provide on-site, immediate response to a spill event. The responders first attempt to stop the flow of oil and may deploy boom to confine oil that has entered the water. The responders may deploy boom to protect major inlets, wash-over channels, and small inlets. Finally, deflection booms would be placed to enclose smaller bays and channels to protect sensitive environmental areas. If the nature of the event exceeds the facility's resources, the Responsible Party calls in its response organization. The Spill Response Team (SRT):

- 1) identifies the threatened area;
- 2) assesses the natural resources, i.e., environmentally sensitive areas such as major fishing areas, spawning or breeding grounds;
- 3) identifies other high-risk areas such as offshore exploration and development sites and tank-vessel operations in the area;
- 4) obtains information on local tides, currents, prevailing winds, and ice conditions; and
- 5) identifies the type, amount, and location of available equipment, supplies and personnel.

The next action would be containment. It is especially important to prevent oil spills from reaching the Beaufort Sea where they could spread rapidly over a large area. Cleanup activities continue as long as

necessary, without any time frame or deadline. A winter spill might require initial on-site response followed by further cleanup of oil melting out of the ice in the spring or summer (USDOJ, MMS 90-0063:M-5).

c. Training

Individual members of the SRT train in basic spill response; skimmer use; detection and tracking of oil; oil recovery on lakes; river booming; radio communications; ATV, snowmobile, and four-wheeler operations; oil discharge, prevention, and contingency plan review; communication equipment operations; Arctic survival; oil spill burning operations; pipeline leak plugging; and spill volume estimations.

d. Response Organizations

Alaska Clean Seas (ACS) is the spill response organization for the North Slope operators. Its area of responsibility covers the North Slope between the Colville and Canning rivers and includes the Alyeska Pipeline corridor to Pump Station No. 4 and the three-mile offshore limit of state waters.

In 1995, ACS was given increased management of all spill response equipment, with the charge to standardize preventative maintenance procedures, develop a common equipment data base, and to strategically reposition spill equipment based on risk. Other duties include record keeping, training, drills and deployment in response situations.

ACS has assigned a lead technician position and a supporting spill technician position to each of the three large fields on the North Slope (Kuparuk, Eastern Operations Area, and Western Operations Area). They have been given responsibility for initial containment and recovery operations under management by the Responsible Party (RP) in those fields and in the vicinity of those fields. In addition to response, these ACS positions conduct and coordinate preventative maintenance and repair of equipment, along with equipment inventorying, pre-staging and pre-deployment (ACS, 1995:2).

Immediate spill response requirements will continue to be met through the use of Spill Response Teams (SRTs) comprised of company and contractor employees at each of the fields who voluntarily enlist in their particular field's SRT. The SRTs are integrated into a single North Slope Spill Response Team (NSRT), comprised of 115 field responders per shift, each of which has or will receive 40 hours of hazardous materials (HAZWOPER) training. The North Slope Operators who furnish the SRTs from their employee and contractor staffs have committed to make the SRT's available on a Slope-wide basis for up to 36 hours upon call-out (ACS, 1995:3).

ACS and the North Slope operators employ a "tiered system" for responding to spills. Small, non-emergency spills are cleaned up by the Operator or ACS personnel. Spills requiring the resources of ACS and the responsible party's SRT are considered "Level I" spills. Depending on activity levels and the duration of work to do, off-site contractor-supplied personnel may be used to complete the cleanup and may be obtained through one or more of the master agreements which ACS maintains with labor contractors (ACS, 1995:3).

If a spill requires more than the resources of ACS and the RP, it is considered to be a Level II spill. Additional manpower resources would be obtained through mutual aid. Mutual aid is a system that utilizes SRTs from companies other than that of the responsible party. Such spills usually require some longer term cleanup. Under its master service agreements, ACS can obtain 100 contract responders within 36 hours (ACS, 1995:3).

If a spill exceeds the resources available on the North Slope, it is classified as a Level III spill. These types of spills will not only receive initial response from the full North Slope Response Team (NSRT), but will likewise require the work of off-site contract responders under ACS's master service agreements (ACS, 1995:3).

ACS established a central Incident Command Post at Deadhorse as a control point for oil spill response radio and telephone systems for the entire North Slope area which extends north from 68 degrees latitude (approximately Cape Seppings on the Chukchi Sea) and east to the Canadian border, including a range of several hundred miles offshore in the Chukchi Sea. This radio and telephone communications system is capable of being rapidly deployed by sea, land, or air to local and remote areas in support of offshore exploration or oil spill response actions. Remote control circuits for nine permanent Very High Frequency

(VHF) repeaters and marine coast stations, installed at strategic locations in the production area and pipeline corridor, are routed via private microwave circuits into the system. Other High Frequency (HF) and Ultra High Frequency (UHF) radios are also connected to the system. Communication is then possible among all users, whether marine-based radios, company headquarters or supply depots, ICP, hand held portable radios, or aircraft radios. This gives each member company access to all of the radio systems, regardless of the type of radio it is using. ACS also has mobile VHF radios and about 150 hand held radios for field use in its oil spill response program (ACS 1991, Vol. 1, No. 2:3), (ACS 1991 Deadhorse Spill Response Telecommunication Center).

Other operational equipment includes four INMARSAT satellite telephone systems, operating independently of wires and separate from the VHF, UHF, and other radio systems, at Deadhorse on the North Slope. The name INMARSAT is derived from "international, marine, satellite." The system can reach anywhere in the world via satellite. An INMARSAT system can be mounted on a boat, in such a way that, regardless of heavy seas or other disturbance, the antenna beam cannot be shaken off the satellite and communication disconnected. Ships, barges, aircraft, oil spill response agencies, ground personnel, and anyone with a telephone can be reached via this system. The equipment is operational now and can be used immediately in case of an emergency anywhere in the state (Wheeler, personal communication, 1991).

ACS designed and built an oil skimmer called Shallow Water Access Mop Platform (SWAMP) for use in the shallow waters between the shore and barrier islands. The vessel is a catamaran with pontoons for hulls. It uses a rope mop of sorbent material that moves through the floating oil and soaks it up. A wringer then removes the oil. The pilot house can be removed and the entire boat can be loaded on a C-130 aircraft for transport to the spill location (LPRC 1989, Vol. 1, No. 1:1).

Acquisitions by ACS include two 38-foot response boats and a 45-foot response boat known as the "Big Dipper," which is an aluminum hulled boat that operates efficiently in only 25 inches of water. The boat is equipped with two LORI skimmers and two 6,000 lb. capacity hydraulic autocranes and has a pulling capacity of 6,500 lbs. (ACS 1991, Vol. 1, No. 1:8).

ACS is also involved with state and federal agencies and local community groups in training North Slope village teams to support oil spill response capability. Intensive training courses for the village team members include winter and summer oil spill operations, hazardous waste operations, oil spill post-emergency response, oil spill assessment, tracking and detection of oil, skimmer operations, incident command, and basic radio voice procedures. The teams take part in field exercises and the annual North Slope mutual aid response exercises. Village members have been asked to provide training for other team members in survival techniques in the arctic, small boat operation techniques in arctic waters, and environmental concerns, because of their unique knowledge of the arctic environment (ACS 1991, Vol. 1, No. 1:2-8).

ACS developed a wildlife protection strategy in cooperation with federal and state government agencies. The strategy utilized guidelines taken from the Wildlife Guidelines for Alaska in the Alaska Region Oil and Hazardous Substances Pollution Contingency Plan produced by the Regional Response Team. Three areas of concern were identified: 1) controlling spilled oil at the source to prevent or reduce contamination of species or their habitat; 2) keeping wildlife away from oiled areas through deterrent techniques; 3) capture and treatment of oiled wildlife. Training courses are being developed to ensure that the hazing, capture, and stabilization are conducted safely for both the wildlife and the personnel involved (ACS 1991, Vol. 1, No. 3:1).

The Alaska Regional Response Team (ARRT) signed a Memorandum of Agreement in February 1991 pre-approving in situ burning as a spill response technique for ACS areas of responsibility north of the Brooks Range and in the Beaufort and Chukchi Seas. Pre-approval vests the final decision with the Federal On-Scene Coordinator (U. S. Coast Guard offshore; EPA or BLM onshore) and facilitates quick decision making (ACS 1991, Vol. 1, No. 1:5).

Important aspects of response are planning, preparation and practice. Each year North Slope and Beaufort Sea operators and state and federal agencies participate in a mutual aid drill.

4. Cleanup and Remediation

Cleanup plans for terrestrial and wetlands spills must balance the objectives of maximizing recovery while minimizing ecological damage. Many past cleanup operations have caused as much or more damage than the oil itself. All oils are not the same, and knowledge of the chemistry, fate and toxicity of the spilled oil can help identify those cleanup techniques that can reduce the ecological impacts of an oil spill. Hundreds of laboratory and field experiments have investigated the fate, uptake, toxicity, behavioral responses, and population and community responses to crude oil. (Jorgenson, 1996)

The best techniques are those that quickly remove volatile aromatic hydrocarbons. This is the portion of oil that causes the most concern regarding the physical fouling of birds and mammals. To limit the most serious effects, it is desirable to remove the maximum amount of oil as soon as possible after a spill. The objective is to promote ecological recovery and not allow the ecological effects of cleanup to exceed those caused by the spill itself. Table 6.1 lists cleanup objectives and techniques that may be applicable to each objective. Table 6.2 compares the advantages and disadvantages of cleanup techniques for crude oil in terrestrial and wetland ecosystems. (Jorgenson, 1996)

Table 6.1 Objectives and Techniques for Cleaning Up Crude Oil in Terrestrial and Wetland Ecosystems (Adapted from Jorgenson, 1996)

Objectives	Cleanup Techniques
Minimize:	
Movement of oil	Absorbent booms Sand bagging Sheet piling
Surface-water contamination	Same as above
Soil infiltration	Flood surface
Soil and vegetation contact and oil adhesion	Flood surface Use surfactants to reduce adhesion
Vegetation damage	Use boardwalks to reduce trampling Use flushing instead of mechanical techniques Perform work when vegetation is dormant
Thawing of Permafrost	Avoid vegetation and surface disturbance
Wildlife contact with oil	Fencing to prevent wildlife from entering site Plastic sheeting to prevent birds from landing on site Guards to haze wildlife Devices to haze wildlife
Acute and chronic toxicity of oil to humans, fish, and wildlife	Removal of oil Enhance biodegradation of remaining oil
Waste disposal	Use flushing Avoid absorbents and swabbing
Cost	Remove oil as fast as possible Achieve acceptable cleanup level quickly to minimize monitoring
Liability	Achieve acceptable cleanup level
Maximize:	
Recovery potential of tundra ecosystems	All of the above Add nutrients to aid recovery of plants
Worker safety	Air testing, training, clothing

Table 6.2 Advantages and Disadvantages of Techniques for Cleaning Up Crude Oil in Terrestrial and Wetland Ecosystems (Adapted from Jorgenson, 1996)

Technique	Advantage	Disadvantage	Recommended
Wildlife:			
Fencing	Keeps out large mammals	Does not keep out birds	Yes
Plastic sheeting	Keeps out both birds and mammals	Can no longer work area	Sometimes
Wildlife guard	Flexibility to respond	Higher cost	Sometimes
Devices	Lower cost	Animals become habituated	No
Containment:			
Absorbent booms	Contains floating oil, quickly deployed	Misses water soluble oil	Yes
Sand bags	Contains both floating and soluble fractions, follows tundra contours	Slower to mobilize, some leakage	Yes
Sheet piling	Maximum containment	Slow to install, doesn't fit contours well	Sometimes
Earthen berms	Can easily be adapted to terrain, heavy equipment rapidly can create berms	Destroys existing vegetation and soil	No
Snow/ice berms	Can be used during winter cleanup or to prevent runoff during breakup	Can only be used during freezing periods	Yes
Contact:			
Flooding	Keeps heavy oil suspended	Spreads out oil	Yes
Surfactants	Reduces stickiness, aids removal, and reduces volatilization	Reduces effectiveness of rope mop skimmer	Yes
Thickening agents	Untried, aids physical removal	Must be well drained, physical removal more difficult	No
Access:			
Boardwalks	Reduces trampling	None	Yes
Removal:			
Complete excavation	Eliminates long-term liability	Eliminates natural recovery, disposal costs	Sometimes
Partial excavation	Quickly reduces oil levels, less waste to dispose of than complete excavation	Causes partial ecological damage, disposal costs, still long-term liability	Sometimes
Burning	Low cost, high removal rate	Little testing, ecological damage	Sometimes
Flushing, high pressure	High removal rate	High ecological damage	No
Flushing, low pressure, cold	Moderate removal rate, little damage, easy waste disposal	Spreads oil, not as effective as warm water	No
Flushing, low pressure, warm	High removal rate, little vegetation damage, easy disposal of waste	Spreads oil	Yes
Aeration	Accelerates volatilization	Volatiles lost to air, may pose risk to humans	Yes
Raking	Can target hot spots	Partial vegetation damage	Sometimes
Cutting and trimming	Targets hot spots, reduces stickiness	Partial vegetation damage	Sometimes

Technique	Advantage	Disadvantage	Recommended
Swabbing	Targets hot spots	Not very effective, adds to waste disposal, adds to trampling	No
Oil skimmers and rope mops	Removes heavier oil, works well with flooding, lowers disposal costs	Requires personnel to push oil to skimmer, adds to trampling	Yes
Vacuum pumping	Removes surface and miscible oil, works well with flooding, lowers disposal cost	None	Yes
Biodegradation	Removes low levels of hydrocarbons, non-destructive, lowers disposal costs	Long-term monitoring, site maintenance, may require wildlife protection	Yes

After a spill, the physical and chemical properties of the individual constituents in the oil begin to be altered by the physical, chemical, and biological characteristics of the environment. This is called weathering. As much as 40 percent of most crude oils may evaporate within a week after a spill. The factors that are most important during the initial stages of cleanup are the evaporation, solubility and movement of the spilled oil. Over the long term, microscopic organisms (bacteria and fungi) break down oil. (Jorgenson, 1996)

Cleanup phases include initial response, remediation and restoration. During initial response, the spiller gains control of the source of the spilling oil; contains the spilled oil; protects the natural and cultural resource; removes, stores and disposes of collected oil; and assesses the condition of the impacted areas. During remediation, the responsible party performs site and risk assessments; develops a remediation plan; and removes, stores and disposes of more collected oil. Restoration attempts to re-establish the ecological conditions that preceded the spill. The restoration phase usually includes a monitoring program to assess the results of the restoration activities. (Jorgenson, 1996)

5. Regulation of Oil Spill Prevention and Response

a. Federal Statutes and Regulations

Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 U.S.C. §9605), and section 311(c)(2) of the Clean Water Act as amended (33 U.S.C. § 1321(c)(2)) require environmental protection from oil spills. CERCLA regulations contain the National Oil and Hazardous Substances Pollution Contingency Plan (40 C.F.R. § 300). Under these regulations, the spiller must plan to prevent and immediately respond to oil and hazardous substance spills and be financially liable for any spill cleanup. If the pre-designated Federal On-Scene Coordinator (FOSC) determines that neither timely nor adequate response actions are being implemented, the federal government will respond then seek to recover cleanup costs from the responsible party.

The Oil Pollution Act of 1990 (OPA 90) requires the development of facility and tank vessel response plans and an area-level planning and coordination structure to coordinate federal, regional, and local government planning efforts with the industry. OPA 90 amended the Clean Water Act (Section 311(j)(4)) which established area committees and area contingency plans as the primary components of the national response planning structure. In addition to human health and safety, these area committees have three primary responsibilities:

1. prepare an area contingency plan;
2. work with state and local officials on contingency planning and preplanning of joint response efforts, including procedures for mechanical recovery, dispersal, shoreline cleanup, protection of sensitive areas, and protection, rescue and rehabilitation of fisheries and wildlife; and
3. work with state and local officials to expedite decisions for the use of dispersants and other mitigating substances and devices.

In Alaska, the area committee structure has incorporated state and local agency representatives, and the jointly prepared plans coordinate the response activities of the various governmental entities that have responsibilities regarding oil spill response. The area contingency plan for Alaska is the Unified Plan and is

discussed below. Since Alaska is so large and geographically diverse, the federal agencies have found it necessary to prepare sub-area contingency plans, also discussed in the Government Contingency Plans section below.

OPA 90 also created two citizen advisory groups, the Prince William Sound and the Cook Inlet Regional Citizens Advisory Councils. The non-profit organizations provide citizen oversight of terminal and tanker operations that may affect the environment in their respective geographic areas. They also foster a long term partnership between industry, government and citizens and carry out responsibilities identified in section 5002 of OPA 90. These include providing recommendations on policies, permits and site-specific regulations for terminal and tanker operations and maintenance and port operations, monitoring terminal and tanker operations and maintenance, and reviewing contingency plans for terminals and tankers and standards for tankers.

The Prince William Sound Regional Citizens Advisory Council (PWSRCAC) consists of 18 member organizations, including communities impacted by the *Exxon Valdez* oil spill, a Native regional corporation and groups representing fishing, aquaculture, environmental, tourism and recreation interests in the impacted area. PWSRCAC is certified under OPA 90 and operates under a contract with Alyeska. The contract, which is in effect as long as oil flows through TAPS, guarantees the council's independence, provides annual funding, and ensures the PWSRCAC the same access to terminal facilities as state and federal regulatory agencies.

b. Alaska Statutes and Regulations

As discussed in Chapter One, ADEC is the agency responsible for implementing state oil spill response and planning regulations under AS 46.04.030. The Departments of Fish and Game and Natural Resources assist ADEC in these efforts by providing expertise and information. The industry must file oil spill prevention and contingency plans with ADEC before operations commence. ADNDR and ADF&G review and comment to ADEC regarding the adequacy of the industry oil discharge prevention and contingency plans (C-plans).

c. Industry Contingency Plans

C-plans for exploration facilities should include a description of methods for responding to and controlling blowouts; the location and identification of oil spill cleanup equipment; the location and availability of suitable drilling equipment; and an operations plan to mobilize and drill a relief well. If development and production should occur, additional contingency plans must be filed for each facility prior to commencement of activity, as part of the permitting process. Any vessels transporting crude oil from the potential development area must also have an approved contingency plan.

AS 46.04.030 provides that no person may:

1. operate an oil terminal facility, a pipeline, or an exploration or production facility, a tank vessel, or an oil barge, or
2. permit the transfer of oil to or from a tank vessel or oil barge, unless an oil discharge prevention and contingency plan has been approved by ADEC, and the operator is in compliance with the plan (AS 46.04.030(a),(b),(c)).

Parties with approved plans are required to have sufficient oil discharge containment, storage, transfer, cleanup equipment, personnel, and resources to meet the response planning standards for the particular type of facility, pipeline, tank vessel, or oil barge (AS 46.04.030(k)). Examples of these requirements are:

- The operator of an oil terminal facility must be able to "contain or control, and clean up" a spill volume equal to that of the largest oil storage tank at the facility within 72 hours. That volume may be increased by ADEC if natural or manmade conditions exist outside the facility which place the area at high risk (AS 46.04.030(k)(1)).
- Operators of exploration or production facilities, or pipelines, must be able to "contain, control, and cleanup the realistic maximum oil discharge within 72 hours." (AS 46.04.030(k)(2)). The "realistic maximum oil discharge" means "the maximum and most damaging oil discharge that [ADEC]

estimates could occur during the lifetime of the tank vessel, oil barge, facility, or pipeline based on (1) the size, location, and capacity; (2) ADEC's knowledge and experience with such; and (3) ADEC's analysis of possible mishaps." (AS 46.04.030(q)(3)).

- For crude oil tank vessels and oil barges with a cargo volume of less than 500,000 bbls, the plan holder must be able, at a minimum, to contain or control, and clean up a discharge of 50,000 bbls within 72 hours (AS 46.04.030(k)(3)(A)). For capacities of 500,000 bbls or more, the cleanup volume must be 300,000 bbls within 72 hours (AS 46.04.030(k)(3)(B)). Additionally, all crude oil tank vessel operators must also maintain equipment, personnel, and other resources as necessary to control or contain and clean up a realistic maximum discharge within the shortest possible time (AS 46.030(k)(3)(C)).

Discharges of oil or hazardous substances must be reported to ADEC on a time schedule depending on the volume released, whether the release is to land or to water, and whether the release has been contained by a secondary containment or structure. For example, any discharge of oil to water in excess of 55 gallons on land not within an impermeable secondary containment area or structure must be reported as soon as the operator has knowledge of the discharge (18 AAC 75.300(a)(1)(B) and (C)).

The discharge must be cleaned up to the satisfaction of ADEC, using methods approved by ADEC. If ADEC determines that clean up efforts are inadequate, the department will either order the person engaged in cleanup operations to use additional methods or to cease cleanup activities, or authorize other agents to begin cleanup activities, or both (18 AAC 75.337(a)). The Departments of Fish and Game and Natural Resources advise ADEC regarding the adequacy of cleanup.

A C-plan must describe the existing and proposed means of oil discharge detection, including surveillance schedules, leak detection, observation wells, monitoring systems, and spill-detection instrumentation. AS 46.04.030; 18 AAC 75.425(e)(2)(E). A C-plan and its preparation, application, approval, and demonstration of effectiveness requires a major effort on the part of facility operators and plan holders. The C-plan must include a response action plan, a prevention plan, and supplemental information to support the response plan (18 AAC 75.425). These plans are described below.

The Response Action Plan (18 AAC 75.425(e)(1) Part 1) must include an emergency action checklist of immediate steps to be taken if a discharge occurs. The checklist must include:

1. names and telephone numbers of people within the operator's organization who must be notified, and those responsible for notifying ADEC;
2. information on safety, communications, and deployment, and response strategies;
3. specific actions to stop a discharge at its source, to drill a relief well, to track the location of the oil on open water, and to forecast the location of its expected point of shoreline contact to prevent oil from affecting environmentally sensitive areas;
4. procedures for boom deployment, skimming or absorbing, lightening, and estimating the amount of recovered oil;
5. plans, procedures, and locations for the temporary storage and ultimate disposal of oil contaminated materials and oily wastes;
6. plans for the protection, recovery, disposal, rehabilitation, and release of potentially affected wildlife; and
7. if shorelines are affected, shoreline clean up and restoration methods.

The Prevention Plan (18 AAC 75.425(e)(2) Part 2) must:

1. include a description and schedule of regular pollution inspection and maintenance programs;
2. provide a history and description of known discharges greater than 55 gallons that have occurred at the facility, and specify the measures to be taken to prevent or mitigate similar future discharges;
3. provide an analysis of the size, frequency, cause, and duration of potential oil discharges, and any operational considerations, geophysical hazards, or other site-specific factors, which might increase the risk of a discharge, and measures taken to reduce such risks.

The Supplemental Information Section (18 AAC 75.425(e)(3) Part 3) must:

1. include bathymetric and topographic maps, charts, plans, drawings, diagrams, and photographs, which describe the facility, show the normal routes of oil cargo vessels, show the locations of storage tanks, piping, containment structures, response equipment, emergency towing equipment, and other related information;
2. show the response command system; the realistic maximum response operation limitations such as weather, sea states (roughness of the sea), tides and currents, ice conditions, and visibility restrictions; the logistical support including identification of aircraft, vessels, and other transport equipment and personnel;
3. include a response equipment list including containment, control, cleanup, storage, transfer, lightering, and other related response equipment;
4. provide non-mechanical response information such as in situ burning or dispersant, including an environmental assessment of such use; and
5. provide a plan for protecting environmentally sensitive areas and areas of public concern.

The current statute allows the sharing of oil spill response equipment, materials, and personnel among plan holders. ADEC determines by regulation the maximum amount of material, equipment, and personnel that can be transferred, and the time allowed for the return of those resources to the original plan holder (AS 46.04.030(o)). The statute also requires the plan holders to “successfully demonstrate the ability to carry out the plan when required by [ADEC]” (AS 46.04.030(r)(2)(E)). ADEC regulations require that exercises shall be conducted to test the adequacy and execution of the contingency plan. No more than two exercises are required annually, unless the plan proves inadequate. ADEC may, at its discretion, consider regularly scheduled training exercises as discharge exercises (18 AAC 75.485(a) and (d)).

d. Financial Responsibility

Holders of approved contingency plans must provide proof of financial ability to respond (AS 46.04.040). Financial responsibility may be demonstrated by one or a combination of 1) self-insurance; 2) insurance; 3) surety; 4) guarantee; 5) approved letter of credit; or 6) other ADEC-approved proof of financial responsibility (AS 46.04.040(e)). Operators must provide proof of financial responsibility acceptable to ADEC as follows:

- for crude oil terminals: \$50 million in damages per incident.
- for a non-crude oil terminal: \$25 per incident for each barrel of total non-crude oil storage capacity at the terminal or \$1 million, whichever is greater, with a maximum of \$50 million.
- for pipelines and offshore exploration or production facilities: \$50 million per incident.
- for onshore production facilities: \$20 million per incident.
- for onshore exploration facilities: \$1 million per incident.
- for crude oil vessels and barges: \$300 per incident, for each barrel of storage capacity or \$100 million, whichever is greater.
- for non-crude oil vessels and barges: \$100 per barrel per incident or \$1 million, whichever is greater, with a ceiling of \$35 million AS 46.04.040(a),(b),(c).
- The coverage amounts are adjusted every third year based on the Consumer Price Index. AS 46.04.045.

e. Government Contingency Plans

In accordance with AS 46.04.200, ADEC must prepare, annually review, and revise the statewide master oil and hazardous substance discharge prevention and contingency plan. The plan must identify and specify the responsibilities of state and federal agencies, municipalities, facility operators, and private parties whose property may be affected by an oil or hazardous substance discharge. The plan must incorporate the incident command system, identify actions to be taken to reduce the likelihood of occurrence of “catastrophic” oil discharges and “significant discharges of hazardous substances” (not oil), and designate the locations of storage depots for spill response material, equipment, and personnel. The state master plan has been combined with the federally required area plan to create the “Alaska Federal/State Plan for Response to Oil and Hazardous Substance Discharges/Releases,” also known as the Unified Plan. (ADEC, 1994).

ADEC must also prepare and annually review and revise a regional master oil and hazardous substance discharge prevention and contingency plan (AS 46.04.210). The regional master plans must contain the same elements and conditions as the state master plan but are applicable to a specific geographic area. The regional plans are being developed in conjunction with the federally required sub-area plans as "Sub-Area/Regional Contingency Plans" for each of the ten designated contingency planning areas. The sub-area plan for the North Slope is in preparation at this time.

6. Mitigation Measures

Recognition of the difficulties of containment and clean up of oil spills has encouraged innovative and effective methods of preventing possible problems and handling them if they arise. Oil spill prevention, response, and cleanup and remediation techniques are continually being researched by state and federal agencies and the oil industry. Although the risk of impact from a spill cannot be reduced to zero, such risk can be minimized through preventive measures, monitoring, and rigorous response capability. In addition to addressing the prevention, detection, and cleanup of releases of oil, Lessee Advisory 7 requires that lessees' contingency plans address the method to be used to detect, respond to, and control blowouts. Also under this measure, contingency plans must identify the location of oil spill cleanup equipment; the location and availability of suitable alternative drilling equipment; and develop a plan of operations to mobilize and drill a relief well.

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Chapter Seven: Issues and Mitigation Measures

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Chapter Seven: Issues and Mitigation Measures

A. Summary of Major Material Issues

The following is a list of issues which the director determined were material to Sale 87's best interest determination. These issues were identified by staff, other agency personnel or members of the public. The comprehensive list of mitigating measures, as they will appear in the lease document, follows the table. A complete summary of public and agency comments, and DO&G's response to those comments, is contained in Appendix A.

Issue	Summary	Mitigation
Access to and protection of subsistence resources and use sites	Lease sale will reduce access to the once open range. Impediments to access include facilities and pipelines. Developers need to avoid traditional use sites.	MM: 12, 14, 15, 21 and LA: 1, 2, 4, 11
Cultural resources and privacy	Increased presence of non-Natives and non-residents near Nuiqsut may offset the balance between traditional and modern lifestyles of Inupiat. Developers need to respect ancestral graves, and educate workers about Inupiat cultural values.	MM: 11, 12, 14, and LA: 1, 2, 4, 11
Disturbance to Birds and Caribou	Increased presence of helicopters and machinery disturbs peace. Aircraft overflights and vehicular traffic may disturb nesting birds, resulting in mortality of young; disturbs migratory routes of caribou resulting in reduced fecundity and survival.	MM: 2, 6, 8, 12, 19, 21 and LA: 1, 5, 6, 9, 10
Habitat Loss and Pollution	More lease sales mean more fish and wildlife habitat loss. Air and water pollution threatens habitats upon which wildlife and man derive sustenance.	MM: 2, 3, 5, 6, 7, 9, 16, 17, 18, 21, and LA: 1, 3, 5, 7, 8, 9, 12
Use of Explosives	Concern that use of explosives for seismic data acquisition will harm fish in lakes and streams.	MM: 1 and LA: 1, 4

B. Mitigation Measures

AS 38.05.035(e) and the departmental delegation of authority provide the director, Division of Oil and Gas (DO&G), 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 selected lease related activities, DO&G has developed mitigation measures and will condition post-sale plans of operation, exploration, or development, and other permits based on these mitigation measures.

Under AS 38.05.035(e), DNR has authority to apply the following mitigation measures for Oil and Gas Lease Sale 87, North Slope Areawide, to all oil and gas activities performed to access the state's leased mineral interest, regardless of the ownership status of the land from which the lessee seeks access.

Lessees must obtain approval of a detailed plan of operations from the Director before conducting exploratory or development activities (11 AAC 83.158). An approved plan of operations is the authorization by which DO&G regulates exploration, development, and production activities.

A plan of operations must identify the specific measures, design criteria, and construction methods and standards to be employed to comply with the restrictions listed below. It must also address any potential geohazards that may exist at the site. Plans of operation must comply with coastal zone consistency review

standards and procedures established under 6 AAC 50 and 80 including coastal district plans. Applications for required state or federal agency authorizations or permits must be submitted with the plan of operations. DO&G will require, as a condition of consistency approval, such modification or mitigation measures as may be necessary to ensure consistency with the ACMP standards.

These measures were developed after considering stipulations and terms imposed in other North Slope oil and gas lease sales; fish and wildlife resource and harvest data submitted by ADF&G; and environmental data relating to air and water quality, solid and liquid waste disposal, and oil spills submitted by ADEC. Measures were also developed or modified after considering comments submitted by the public, industry, federal and state agencies, and local government. Additional project-specific mitigation measures will be imposed if and when oil and gas lessees submit plans of exploration, operation, or development.

In addition to compliance with these mitigation measures, lessees must comply with all applicable local, state and federal codes, statutes and regulations, and any subsequent amendments. Federal, state and local government powers to regulate the oil and gas industry are discussed in the "Governmental Powers to Regulate Oil and Gas Exploration, Development, Production, and Transportation" in Chapter One of this finding. Additionally, some applicable federal and state statutes and regulations are presented in Appendix B.

Information to lessees relevant to Sale 87 is also presented in the "Lessee Advisories," section C of this Chapter. This section contains important information to lessees and operators regarding the Sale 87 area. It also includes precautions which may apply to post-lease sale activities, and reflect existing local, state, and federal law or policy at the time of the sale.

The following abbreviations are used in these mitigation measures: Alaska Coastal Management Program (ACMP), Alaska Department of Environmental Conservation (ADEC), Alaska Department of Fish and Game (ADF&G), Alaska Department of Natural Resources (ADNR), Division of Land (DL), Division of Governmental Coordination (DGC), Division of Mining and Water Management (DMWM), Director, Division of Oil and Gas (Director), Division of Parks and Outdoor Recreation (DPOR), National Pollutant Discharge Elimination System (NPDES), North Slope Borough (NSB), North Slope Borough Municipal Code (NSBMC), North Slope Borough Coastal Management Plan (NSBCMP), State Historic Preservation Officer (SHPO), Spill Prevention Control and Countermeasure (SPCC), and the U.S. Fish and Wildlife Service (USF&WS).

Except as indicated, the restrictions listed below do not apply to geophysical exploration on state lands; geophysical exploration activities are governed by 11 AAC 96. See lessee advisory four, Section C of this Chapter.

The following mitigation measures and advisories will be imposed on oil and gas activities in or on all Sale 87 leased lands and waterbodies as a condition of the approval of plans of operation:

1. General Measures

1. a. Explosives must not be detonated within, beneath, or in close proximity to fishbearing waters if the detonation of the explosive produces a pressure rise in the waterbody greater than 2.5 pounds per square inch (psi) unless the waterbody, including its substrate, is solidly frozen.

Explosives must not produce a peak particle velocity greater than 0.5 inches per second (ips) in a spawning bed during the early stages of egg incubation. The minimum acceptable offset from fishbearing streams and lakes for various size buried charges is:

1 pound charge	37 feet
2 pound charge	52 feet

5 pound charge	82 feet
10 pound charge	116 feet
25 pound charge	184 feet)
100 pound charge	368 feet

Specific information on the location of fishbearing waterbodies may be obtained by contacting ADF&G.

- b. The lessee will consult with the NSB prior to proposing the use of explosives for seismic surveys. The director may approve the use of explosives for seismic surveys after consultation with the NSB.
2. Except for approved off-road travel, exploration activities must be supported only by ice roads, winter trails, existing road systems or air service. Wintertime off-road travel across tundra and wetlands may be approved in areas where snow and frost depth are sufficient to protect the ground surface. Summertime off-road travel across tundra and wetlands may be authorized subject to time periods and vehicle types approved by DL. Exceptions may be granted by the director, DL, and the Director, if an emergency condition exists or if it is determined, after consulting ADF&G, that travel can be accomplished without damaging vegetation or the ground surface.
3. a. Removal of water from fishbearing rivers, streams, and natural lakes shall be subject to prior written approval by DMWM and ADF&G.
b. Removal of snow cover from fishbearing rivers, streams, and natural lakes shall be subject to prior written approval by ADF&G. Compaction of snow cover overlying fishbearing waterbodies will be prohibited except for approved crossings. If ice thickness is not sufficient to facilitate a crossing, ice and/or snow bridges may be required.
4. Water intake pipes used to remove water from fishbearing waterbodies must be surrounded by a screened enclosure to prevent fish entrainment and impingement. Screen mesh size shall not exceed 0.04 inches unless another size has been approved by ADF&G. The maximum water velocity at the surface of the screen enclosure may be no greater than 0.1 foot per second.

2. Facilities and Structures

5. Lessees must minimize the impact of industrial development on key wetlands. Key wetlands are those wetlands that are important to fish, waterfowl, and shorebirds because of their high value or scarcity in the region. Lessees must identify on a map or aerial photograph the largest surface area, including future expansion areas, within which a facility is to be sited or an activity is to occur. The map or photograph must accompany the plan of operations. DO&G will consult with ADF&G to identify the least sensitive areas within the area of interest. To minimize impacts, the lessee must avoid siting facilities in the identified sensitive habitat areas, unless no feasible and prudent alternative exists.
6. Exploration facilities, with the exception of artificial gravel islands, must be temporary and must be constructed of ice unless the Director determines that no feasible and prudent alternative exists. Re-use of abandoned gravel structures may be permitted on a case-by-case basis by the Director, after consultation with the director, DL, and ADF&G. Approval for use of abandoned structures will depend on the extent and method of restoration needed to return these structures to a usable condition.
7. a. Pipelines must be located so as to facilitate the containment and cleanup of spilled hydrocarbons. Where feasible and prudent, onshore pipelines must be located on the upslope side of roadways and construction pads unless the director, DL, determines that an alternative site is environmentally

acceptable. Wherever possible, onshore pipelines must utilize existing transportation corridors and be buried where soil and geophysical conditions permit.

- b. All pipelines, including flow and gathering lines, must be designed and constructed to provide adequate protection from water currents, storm and ice scouring, subfreezing conditions, and other hazards as determined on a case-by-case basis.
8. Pipelines shall be designed and constructed to avoid significant alteration of caribou and other large ungulate movement and migration patterns. At a minimum, above ground pipelines shall be elevated five feet, as measured from the ground to the bottom of the pipe, except where the pipeline intersects a road, pad, or a ramp installed to facilitate wildlife passage. ADNR may, after consultation with ADF&G, require additional measures to mitigate impacts to wildlife movement and migration.

3. Gravel mining and use

9. Gravel mining sites required for exploration and development activities will be restricted to the minimum necessary to develop the field efficiently and with minimal environmental damage. Where feasible and prudent, gravel sites must be designed and constructed to function as water reservoirs for future use. Gravel mine sites required for exploration activities must not be located within an active floodplain of a watercourse unless the director, DL, after consultation with ADF&G, determines that there is no feasible and prudent alternative, or that a floodplain site would enhance fish and wildlife habitat after mining operations are completed and the site is closed.

Mine site development and rehabilitation within floodplains must follow the procedures outlined in McLean, R. F. 1993, *North Slope Gravel Pit Performance Guidelines*, ADF&G Habitat and Restoration Division Technical Report 93-9.

10. (a) The state of Alaska discourages the use of continuous-fill causeways. Environmentally preferred alternatives for field development include use of buried pipelines, onshore directional drilling, or elevated structures. Approved causeways must be designed, sited, and constructed to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics (e.g., salinity, temperature, suspended sediments) that result in exceedances of water quality criteria, and must maintain free passage of marine and anadromous fish.

(b) Causeways and docks shall not be located in river mouths or deltas. Artificial gravel islands and bottom founded structures shall not be located in river mouths or active stream channels on river deltas, except as provided for in (c).

(c) Each proposed structure will be reviewed on a case-by-case basis. Causeways, docks, artificial gravel islands and bottom founded structures may be permitted if the Director, in consultation with ADF&G, ADEC, and the NSB determines that a causeway or other structures are necessary for field development and that no feasible and prudent alternatives exist. A monitoring program may be required to address the objectives of water quality and free passage of fish, and mitigation shall be required where significant deviation from objectives occurs.

4. Prehistoric, Historic, and Archeological Sites

11. Prior to any ground disturbing activity resulting from exploration, development or production activities, the lessee must conduct an inventory of prehistoric, historic and archeological sites within the area affected by activity. The inventory must include consideration of literature provided by the NSB and local residents, documentation of oral history regarding historic and prehistoric 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 potential effects that might result from the activity. The inventory must be submitted to the Director for distribution to DPOR and the NSB for review and comment. In the event that an archeological, prehistoric or historical site or area may be adversely affected by an activity, the Director, after consulting DPOR, and the NSB, will direct the lessee as to what course of action will be necessary to avoid or minimize the adverse effect.

Discovery of prehistoric, historic, or archaeological objects: In the event any site, structure, or object of prehistoric, historic, or archaeological significance is discovered during leasehold operations, the lessee must immediately report such findings to the Director and the lessee must make every reasonable effort to preserve and protect such site, structure, or object from damage until the Director, after consulting the SHPO, has given directions as to its preservation.

5. Training

12. The lessee must include in any plan of exploration or plan of development a training program for all personnel, including contractors and subcontractors, involved in any activity. The program must be designed to inform each person working on the project of environmental, social, and cultural concerns which relate to the individual's job.

The program must employ effective methods to ensure that personnel understand and use techniques necessary to preserve geological, archeological and biological resources. In addition, the program must also be designed to help personnel increase their sensitivity and understanding of community values, customs, and lifestyles in areas where they will be operating. The program must include an explanation of the applicable laws protecting cultural and historic resources. The program shall address the importance of not disturbing archeological, cultural and historic resources and provide guidance on how to avoid disturbance.

6. Local Hire

13. To the extent they are available and qualified, the lessee is encouraged to employ local and Alaska residents and contractors for work performed on the leased area. Lessees shall submit, as part of the plan of operations, a proposal detailing the means by which the lessee 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 lessee is encouraged, in formulating this proposal, to coordinate with employment services offered by the state of Alaska and local communities and to recruit employees from local communities.

7. Subsistence Harvest Protection

14. a. Exploration, development or production operations shall be conducted in a manner that prevents unreasonable conflicts between lease related activities and subsistence activities. In enforcing this mitigation measure the division, during review of plans of operation, will work with other agencies and the public to assure that potential conflicts are identified and avoided to the fullest extent possible. Available options include alternative site selection, requiring directional drilling, seismic and threshold depth restrictions, subsea completion techniques, seasonal drilling restrictions, and the use of other technologies deemed appropriate by the Director.
- b. Prior to submitting a plan of operations for both onshore and offshore activities which have the potential to disrupt subsistence activities, the lessee shall consult with the potentially affected

subsistence communities and the North Slope Borough (NSB) (collectively “parties) to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures which could be implemented by the operator to prevent unreasonable conflicts. The parties shall also discuss the reasonably foreseeable effect on subsistence activities of any other operations in the area that they know will occur during the lessee’s proposed operations. Through this consultation, the lessee shall make reasonable efforts to assure that exploration, development, and production activities are compatible with subsistence hunting and fishing activities and will not result in unreasonable interference with subsistence harvests.

- c. A discussion of resolutions reached or not reached during the consultation process and plans for continued consultation shall be included in the plan of operations. The lessee shall identify who participated in the consultation and send copies of the plan to participating communities and the NSB when it is submitted to the division.
 - d. If the parties cannot agree, then any of them may request the Commission of DNR or his designee to assemble the parties. The commissioner may assemble the parties or take other measures to resolve conflicts among the parties.
 - e. The lessee shall notify the director of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns.
 - f. Lease-related use will be restricted when the Director determines it is necessary to prevent unreasonable conflicts with subsistence harvests.
15. No restriction of public access to, or use of, the lease area will be permitted as a consequence of oil and gas activities except in the immediate vicinity of drill sites, buildings and other related facilities. Areas of restricted access must be identified and a rationale justifying the area restriction must be included in the plan of operations.

8. Title 16 Streams

16. Under Title 16 of the Alaska statutes, the measures listed below will be imposed by ADF&G below the ordinary high water mark in designated anadromous streams and fishbearing streams for activities that could block fish passage. Exceptions to these requirements, including exceptions for the use of spill containment and recovery equipment, may be allowed on a case-by-case basis. Specific information on the location of anadromous waterbodies in and near the area may be obtained from ADF&G.
- a. Alteration of river banks, except for approved permanent crossings, will be prohibited.
 - b. Except for approved stream crossings, equipment must not be operated within willow stands (*Salix* spp.).
 - c. The operation of equipment, excluding boats, in open water areas of rivers and streams will be prohibited.
 - d. Bridges are the preferred watercourse crossings in fish spawning and important rearing habitats. In areas where culverts are used, they must be designed, installed, and maintained to provide efficient passage of fish.

9. Waste Disposal

17. Solid Waste Disposal

- a. Garbage and domestic combustible refuse must be incinerated. Nonburnables must be disposed of at an approved upland site.
- b. The preferred method for disposal of muds and cuttings from oil and gas activities is by underground injection. Injection of non-hazardous oil field wastes generated during development is regulated by AOGCC through its Underground Injection Control (UIC) Program for oil and gas wells. Annular disposal of muds and cuttings associated with drilling an exploratory well is permitted by ADEC. Surface discharge of drilling muds and cuttings into lakes, streams, rivers, and high value wetlands is prohibited. Surface discharge of drilling muds and cuttings into reserve pits shall be allowed only when the Director, in consultation with ADEC, determines that alternative disposal methods are not feasible and prudent. If use of a reserve pit is 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. Onpad temporary cuttings storage will be allowed as necessary to facilitate annular injection and/or backhaul operations.
- c. Proper disposal of garbage and putrescible waste is essential to minimize attraction to wildlife. The lessee must use the most appropriate and efficient method to achieve this goal. The primary method of garbage and putrescible waste disposal is prompt, on-site incineration in compliance with state of Alaska air quality regulations in 18 AAC 50. The secondary method of disposal is on-site frozen storage in animal-proof containers with backhaul to an approved waste disposal facility. The tertiary method of disposal is on-site non-frozen storage in animal proof containers with backhaul to an approved waste disposal facility. Daily backhauling of non-frozen waste only must be achieved unless safety considerations prevent this.

18. Wastewater disposal:

- a. Unless authorized by NPDES or state permit, disposal of wastewater into freshwater bodies, including Class III, IV, VI, and VIII wetlands, is prohibited.
- b. Surface discharge of reserve pit fluids will be prohibited unless authorized by ADEC permit and approved by DL.
- c. Disposal of produced waters in upland areas, including wetlands, will be by subsurface disposal techniques. ADEC may permit alternate disposal methods if the lessee demonstrates that subsurface disposal is not feasible or prudent.
- d. Discharge of produced waters into open or ice-covered marine waters of less than 10 meters (33 feet) in depth is prohibited. The commissioner, ADEC may approve discharges into waters greater than 10 meters in depth based on a case-by-case review of environmental factors and consistency with the conditions of a state certified development and production phase NPDES permit issued for the sale area.

10. Specific Measures

19. Birds: Permanent, staffed facilities must be sited to the extent feasible and prudent outside identified brant, white-fronted goose, snow goose, tundra swan, king eider, common eider, Steller's eider, spectacled eider, and yellow-billed loon nesting and brood rearing areas.

20. Bears:

- a. Exploration and production activities must not be conducted within one-half mile of occupied grizzly bear dens, unless alternative mitigative measures are approved by ADF&G. Known den sites shall be obtained from the Division of Wildlife Conservation, ADF&G, phone 459-7213, prior to commencement of any activities. Occupied dens encountered in the field must be reported to the above, and subsequently avoided by one-half mile.
- b. Operations must avoid known polar bear dens by one mile. Known den locations shall be obtained from the US Fish & Wildlife Service (907-786-3800) prior to starting operations. New dens encountered in the field must be reported to the above, and subsequently avoided by one mile. If a polar bear should den within an existing development, off-site activities shall be restricted to minimize disturbance.
- c. For projects in close proximity to areas frequented by bears, lessees will be encouraged to prepare and implement bear interaction plans to minimize conflicts between bears and humans. These plans could include measures to (a) minimize attraction of bears to the drillsites; (b) organize layout of buildings and work areas to minimize human/bear interactions; (c) warn personnel of bears near or on drillsites and the proper procedures to take; (d) if authorized, deter bears from the drillsite; (e) provide contingencies in the event bears do not leave the site or cannot be deterred by authorized personnel; (f) discuss proper storage and disposal of materials that may be toxic to bears; and (g) provide a systematic record of bears on the site and in the immediate area. The ADF&G has offered to assist lessees in developing educational programs and camp layout and management plans as lessees prepare their lease operations plans.

21. Waterbody Buffers:

- a. To the extent feasible and prudent, onshore facilities other docks, or road and pipeline crossings, will not be sited within 500 feet of fishbearing streams. Additionally, to the extent feasible and prudent, facilities will not be sited within one-half mile of the banks of the main channel of the Colville, Canning and Sagavanirktok, Kavik, Shaviovik, Kadleroshilik, Echooka, Ivishak, Kuparuk, Toolik, Anaktuvuk and Chandler Rivers. Facilities will not be sited within 500 feet of all other fishbearing waterbodies. Essential facility siting will be allowed in buffer areas in those instances where no other suitable sites are available. Facilities will not be sited within buffers unless the Director, after consulting ADF&G, determines that such facility restrictions are not feasible or prudent. Road and pipeline crossings must be aligned perpendicular or near perpendicular to watercourses.
- b. No facilities will be sited within one-half mile of identified Dolly Varden both overwintering/spawning areas on the Kavik, Canning and Shaviovik Rivers. Road and pipeline crossings will not be sited within these buffers unless the Director, after consulting ADF&G, determines that such facility restrictions are not feasible or prudent. * Exception – ADF&G.

C. Lessee Advisories

1. Local Ordinance

Lessees are advised that the NSB Assembly has adopted a comprehensive plan and land management regulations under Title 29 of the Alaska Statutes (AS 29.40.020-040). The NSB regulations require borough approval for all proposed uses, development and master plans. The NSBCMP policies are included as part of the NSB zoning regulations (19.70.060) and all NSB permit approvals will require the proposal to be substantially consistent with these policies. The NSB likely will aggressively assert its land

management powers to the fullest extent permissible under law to address any outstanding concerns regarding impacts to the area's fish and wildlife species and to habitat and subsistence activities.

Restricting access to and use of fish camps and other subsistence use areas defined in the NSB Traditional Land Use Inventory, may violate NSBCMP and NSBMC subsistence harvest protection and land use regulations. Lessees are advised to consult with the NSB Planning Department and local communities during planning of operations.

To comply with NSB Policy regarding the mining of beaches, barrier islands, or offshore shoals, in those circumstances where no feasible and prudent alternatives exist, substantial alteration of shoreline dynamics is prohibited.

2. Community Participation in Operations Planning

Lessees are encouraged to bring one or more residents of communities in the area of operations into their planning process. Local communities have a unique understanding of their environment and community activities. Involving local community residents in the earliest stages of the planning process for oil and gas activities can be beneficial to the industry and to the community. Community representation on management teams developing plans of operation, oil spill contingency plans, and other permit applications can help communities understand permitting obligations and help industry to understand community values and expectations for oil and gas operations being conducted in and around their area.

3. Wetlands Identification

The wetlands referred to in Mitigation Measures 5, and 19 are based on a classification system developed by Bergman et al (USF&WS Resource Publication 129, 1977 Waterbirds and Their Wetland Resources in Relation to Oil Development at Storkersen Point, Alaska). Lessees are advised that the state may adopt or approve the use of an alternative wetlands classification system in the future, however, the protective nature of the wetlands mitigation measures developed for this and other oil and gas lease sales will remain consistent regardless of the wetlands classification ultimately selected.

4. Geophysical Activity

Except as indicated, the mitigation measures listed above do not apply to geophysical exploration on state lands; geophysical exploration activities are governed by 11 AAC 96. In conducting offshore geophysical surveys, neither the lessees or their agents will use explosives in open water areas.

Lessees may or may not propose operations which include seismic surveys in the Sale 87 lease area, and may not therefore have any control over those activities. However, if they are post-lease seismic surveys conducted by or contracted by the lessee, they may be considered lease-related activities. Consequently, restrictions on geophysical exploration permits, whether lease related or not, will depend on the size, scope, duration, and intensity of the project. They will also depend on the extent of effects on important species, specifically marine mammals.

Copies of the non-proprietary portions of all Geophysical Exploration permit applications will be made available to the NSB, AEWC, and potentially affected subsistence communities for comment.

5. Bird, Fish, and Marine Mammal Protection

- a. Lessees shall comply with the Recommended Protection Measures for Spectacled Eiders developed by the USF&WS to ensure adequate protection of spectacled eiders during the nesting and brood rearing

periods. Lessees shall comply with the Recommended Protection Measures for Steller's eider once they are developed by the USFWS.

- b. Peregrine falcon nesting sites are known to occur in the Sale 87 area. Lessees are advised that disturbing a peregrine falcon nest violates federal law. Lessees are required to comply with the federal resource recovery plan for the arctic peregrine falcon.
- c. To minimize impacts on Dolly Varden (arctic char) overwintering areas, permanent, staffed facilities must be sited to the extent feasible and prudent outside identified Dolly Varden (arctic char) overwintering areas.
- d. Lessees are advised that they must comply with the provisions of the Marine Mammal Protection Act of 1972 as amended.

6. Aircraft Restrictions:

In order to protect species that are sensitive to noise or movement, horizontal and vertical buffers will be required, consistent with aircraft, vehicle and vessel operations regulated by NSB Code §19.70.050(I)(1) which codifies NSBCMP policy 2.4.4.(a). Lessees are encouraged to apply the following provisions governing aircraft operations in and near the sale area:

- a. From June 1 to August 31, aircraft overflights must avoid identified brant, white-fronted goose, tundra swan, king eider, common eider, and yellow-billed loon nesting and brood rearing habitat, and from August 15 to September 15, the fall staging areas for geese, tundra swans, and shorebirds, by an altitude of 1,500 feet, or a lateral distance of one mile.
- b. To the extent feasible and prudent, all aircraft should maintain an altitude of greater than 1,500 feet or a lateral distance of one mile, excluding takeoffs and landings, from caribou and muskoxen concentrations. A concentration means numbers of animals in excess of the general density of those animals found in the area.
- c. Human safety will take precedence over flight restrictions.

7. Oil Discharge Prevention and Contingency Plans (C-Plans)

Oil and hazardous substance pollution control: In addition to addressing the prevention, detection, and cleanup of releases of oil, contingency plans (C-Plans) for oil and gas extraction operations should include, but not be limited to;

- a. methods for detecting, responding to, and controlling blowouts;
 - b. the location and identification of oil spill cleanup equipment;
 - c. the location and availability of suitable alternative drilling equipment;
 - d. a plan of operations to mobilize and drill a relief well;
8. a. To conform with ADEC requirements, impermeable lining and diking, or equivalent measures such as double-walled tanks, will be required for onshore oil storage facilities (with a total above ground storage capacity greater than 1,320 gallons, provided no single tank capacity exceeds 660 gal) and for sewage ponds. Additional site-specific measures may be required as determined by ADNR, with the concurrence of ADEC, and will be addressed in the existing review of project permits or Oil Discharge Prevention and Contingency Plans (C-Plans).
- b. Buffer zones of not less than 500 feet will be required to separate onshore oil storage facilities (with a capacity greater than 660 gallons) and sewage ponds from freshwater supplies, streams, and lakes and

key wetlands unless the Director after consultation with ADEC, determines that such a requirement is not feasible or prudent. Reserve pits, if used must be impermeable and otherwise fully contained through diking or other means. * Exception – ADEC.

9. Sensitive Areas

Lessees are advised that certain areas are especially valuable for their concentrations of marine birds, marine mammals, fishes, or other biological resources; cultural resources; and for their importance to subsistence harvest activities. The following areas must be considered when developing plans of operation. Identified areas and time periods of special biological and cultural sensitivity include:

- a. the Canning River Delta, January-December;
- b. the Colville River Delta, January-December;
- c. the Sagavanirktok River delta, January-December.

10. Lessees are encouraged in planning and design activities to consider the recommendations for oil field design and operations contained in the final report to the Alaska Caribou Steering Committee: Cronin, M. et al, 1994. "Mitigation of the Effects of Oil Field Development and Transportation Corridors on Caribou." LGL Alaska Research Associates, Inc., July.

11. Access

No lease facilities or operations may be located so as to block access to, or along, navigable and public waters as defined by AS 38.05.965(13) and (17).

12. Hydrocarbon Emissions

- a. Because of the state's interest in encouraging clean air, lessees are encouraged to adopt conservation measures to reduce hydrocarbon emissions.
- b. The state recognizes that in the long run sources of energy other than oil and gas will be needed. Lessee participation in conducting research on alternative energy sources is appreciated.

Chapter Eight: Bidding Method and Lease Terms

Chapter Eight: Bidding Method and Lease Terms

The selection of the bidding method, minimum bid, and term of the lease occurs after all comments and issues on this final finding have been received by the DO&G, considered and weighed. Under AS 38.05.180(f) and 11 AAC 83.100, the commissioner must lease all oil and gas resources by competitive bidding. The Alaska statutes provide a number of bidding methods to the department. AS 38.05.180(f).

- (1) a cash bonus bid with a fixed royalty share reserved to the state of not less than 12.5 percent in amount or value of the production removed or sold from the lease;
- (2) a cash bonus bid with a fixed royalty share reserved to the state of not less than 12.5 percent in amount or value of the production removed or sold from the lease and a fixed share of the net profit derived from the lease of not less than 30 percent reserved to the state;
- (3) a fixed cash bonus with a royalty share reserved to the state as the bid variable but no less than 12.5 percent in amount or value of the production removed or sold from the lease;
- (4) a fixed cash bonus with the share of the net profit derived from the lease reserved to the state as the bid variable;
- (5) a fixed cash bonus with a fixed royalty share reserved to the state of not less than 12.5 percent in amount or value of the production removed or sold from the lease with the share of the net profit derived from the lease reserved to the state as the bid variable;
- (6) a cash bonus bid with a fixed royalty share reserved to the state based on a sliding scale according to the volume of production or other factor but in no event less than 12.5 percent in amount or value of the production removed or sold from the lease;
- (7) a fixed cash bonus with a royalty share reserved to the state based on a sliding scale according to the volume of production or other factor as the bid variable but not less than 12.5 percent in amount or value of the production removed or sold from the lease.

Prior to issuing a final finding, the department conducts a pre-sale analysis of economic, engineering, geological, and geophysical data, including the petroleum potential. Much of these data are held confidential under AS 38.05.035(a)(9)(C) and (D). The data are then used to determine the bidding method, minimum bid, and lease term that best achieves the mix of sometimes conflicting state interests as listed below for Sale 87. Using standard economic benefit-cost and statistical decision theory, the value of the hydrocarbon resources is determined. The bidding method finally selected is the one the department believes will maximize the economic and physical recovery of the resource, and promote competition among individuals and companies seeking to explore and develop the area.

The bidding method selected for Sale 87 is cash bonus bid. The minimum bid is \$5 per acre. There will be a fixed 12-1/2 percent royalty. The initial term is 7 years. There will be no exploration incentive credits for this sale.

In selecting the bidding method for Sale 87, the department considered and balanced the following state interests: protecting the state's ownership interest in hydrocarbon resources, promoting competition among individuals seeking to explore and develop the area, encouraging orderly and efficient exploration and development; and the need to generate revenues for the state.

Chapter Nine: Conclusion Decision of the Director

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Chapter Nine: Conclusion and Request for Comments

DO&G is required by AS 38.05.035(e) and (g), to determine prior to an oil and gas lease sale, whether the sale best serves the state's interests. As the director of DO&G, my responsibility is to make that determination for Sale 87, North Slope Areawide. In making this decision for the final finding, I will balance the reasonably foreseeable positive and negative effects to determine whether the potential benefits exceed the potential negative effects and whether holding Sale 87 is in the best interests of the state.

In this final finding analysis, DO&G considered the reasonably foreseeable potential effects, both negative and positive, that this sale could have on fish, wildlife, and human users of these resources, on the local economy and well-being, and on state revenue. DO&G analyzed the available socioeconomic, environmental, geological and geophysical data and comments submitted by state and federal agencies, the petroleum industry, and local governments. The division has also considered the cumulative effects of development in the area.

A. Reasonably Foreseeable Effects of the Sale and Subsequent Activity

The discussion throughout this finding, and the record reflect the analysis of the issues. Below is a summary of this analysis.

1. Cumulative Effects

a. Effects on Fish and Wildlife and their Habitats

Fish: Potential impacts in the exploration phase include degradation of streambanks and overwintering areas due to erosion and sedimentation. Potential impacts in future 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, oil spills, unregulated discharge, and seismic activities. Long-term impacts may include habitat improvement due to restoration and rehabilitation of impacted sites.

Birds: Potential impacts are more likely to occur after the exploration phase, as few species are present during winter. Potential impacts include habitat loss, barriers to movement, disturbance during nesting and brooding, and oil spills.

Caribou: Potential impacts are more likely to occur after the exploration phase. Potential effects to caribou populations include migration disturbance and displacement from insect relief and preferred calving areas due to the construction, siting and operation of onshore facilities, roads and above-ground pipelines. Oil spills might also adversely affect caribou.

Grizzly Bear: During exploration, this bear species is most likely to be affected by disturbances during denning. During development and production, human activity may attract foraging bears to facilities, especially refuse disposal sites.

Muskoxen: During exploration and development, fixed-wing aircraft operations could disturb muskoxen in winter and during summer calving. Potential effects to muskoxen due to construction and operation of onshore facilities include displacement from overwintering and calving areas.

Foxes and Other Furbearers: During exploration and development, human activity may attract foraging foxes, especially to refuse disposal areas. Oil spills may reduce available habitat and food for all furbearers.

Polar Bears: Potential impacts to polar bears can occur during all phases. Impacts include disruption of denning, harm from oil spills, alteration of habitat, and adverse interaction with humans.

Pinnipeds: Potential impacts to pinnipeds (seals and walrus) can occur during all phases. Impacts include alteration of habitat, disturbance, and harm from oil spills and unregulated discharges.

b. Effects on Subsistence Uses

Potential impacts to subsistence include reduced or obstructed access to subsistence harvest areas, perceived or actual loss of values associated with hunting and fishing, damage to fish and wildlife habitats, and possible reductions in local fish and wildlife abundance. Other potential impacts include increased access to harvest areas from new roads, and an increase in available cash income to supplement family income and pay for subsistence harvest gear, tools, and supplies.

c. Effects on Historic and Cultural Resources

Potential impacts could occur in all phases, but are likely to occur during the development phase. Potential impacts include disruption of culture and disturbance of historic, prehistoric, and archeological sites. Previously unidentified or undiscovered sites could be damaged if the pre-construction historic resources inventory was incomplete. They could also be damaged if project workers were not adequately trained.

d. Effects on Municipalities and Communities

2. Fiscal Effects

The backdrop for any fiscal analysis and discussion is the current state revenue picture, including revenue sources, demand or need for revenues, and projected declines.

The primary source of state revenues is North Slope oil production. North Slope fields hold 98 percent of the state's known oil reserves and 90 percent of the state's known gas reserves. The remainder of state oil and gas reserves are found in Cook Inlet fields. However, oil and gas reserves are finite resources and North Slope production is declining. Even if the price of crude oil remained at present levels, general fund receipts will continue to decline (see Chapter Five). Hopefully, discovery and development of smaller, but important fields will temper the anticipated decline in revenues to the state treasury.

Most revenues generated from oil and gas activities go into the state's general fund, while some are set aside for the state permanent fund. Many funds, including oil and gas property taxes, are passed directly through to borough and municipal governments. Statewide, Alaskans receive direct and indirect benefits derived from general fund spending. General fund receipts are allocated to local governments and all state agencies, including the University of Alaska. Funds can be passed directly to local governments through programs, while others are authorized specifically by the state legislature.

If the lease sale proceeds, there will be a one-time increase in state income from bonus payments, and an annual increase from rental payments. The potential for additional revenue from royalties and taxes is unpredictable, however, overall petroleum potential for the sale area is low to moderate. As exploration takes place, the sale would add jobs to the state and regional economy. These jobs would not be limited to the petroleum industry, but would be spread throughout the trade, transportation, service, and construction industries. The number of jobs produced would depend on whether commercial quantities of oil and gas are discovered, and whether projects to develop those resources are initiated. Discovery and development of commercial quantities of petroleum or natural gas in the Sale 87 area would bring direct economic benefits to the NSB in the form of additions to local property tax revenue. Additionally, industry investment in environmental and wildlife studies, planning and design activities, materials acquisition, facility construction, seismic surveys, drilling, transportation, and logistics contributes to the well being of both the state and local economy.

B. Specific Issues Related to Oil and Gas Exploration, Development, Production, and Transportation

1. Geophysical Hazards

Geophysical hazards that must be considered during development of production and transportation facilities are faults and earthquakes, permafrost, seasonal flooding and icing, coastal and riverbank erosion, coastal currents and storm surges, unstable and overpressured sediments, shallow gas deposits, and natural gas hydrates.

2. Likely Methods of Transportation

Elevated or buried flow, gathering, and common carrier pipelines would carry petroleum from wellheads to processing centers, and eventually into TAPS. Elevated pipelines can restrict caribou and other wildlife movements, especially if accompanied by a road with regular vehicle traffic. Buried pipelines have little impact on wildlife, but cannot be visually inspected and must be designed to avoid thawing of frozen soil.

3. Oil Spill Risk, Prevention, and Response

Exploration and development of the Sale 87 area will create a potential for oil spills. The likelihood of a large onshore oil spill is small, but may impact habitat, fish and wildlife populations in the immediate vicinity of the spill.

C. Mitigation Measures

Mitigation measures and lessee advisories (listed in Chapter Seven), and other regulatory requirements have been developed to mitigate potential impacts if exploration and subsequent development should occur in the Sale 87 area. These include:

1. Municipalities and Communities

- Environmental Protection -- Numerous measures are designed to protect environmental quality and the habitats that support important subsistence resources. Other measures are designed to protect key species, like caribou, birds, and fish, from potential adverse effects of oil and gas activities. Because of the state's interest in encouraging clean air, lessees are encouraged to adopt conservation measures to reduce hydrocarbon emissions.
- Access to Resources -- Restricting access to subsistence resources is prohibited under ACMP and local ordinances. Access to identified traditional use sites shall not be infringed. No restriction of public access to, or use of, the lease sale area due to oil and gas activity will be permitted, except within the immediate vicinity of drill sites, buildings and other related facilities. Any area of restricted access must be justified in the plan of operations.
- Subsistence Conflict Resolution -- Prior to initiating any activity which may disrupt subsistence harvesting, lessees must consult with the NSB and the affected community before plans of operation can be approved. Plans of Operation must include a discussion of the reasonably foreseeable effect on subsistence activities of any other operations in the area that lessees know will occur during the lessee's proposed operations. Lease-related use will be restricted when the Director determines it is necessary to prevent unreasonable conflicts with subsistence harvests. The Commissioner of ADNR may assemble affected parties or take other measures to resolve conflicts.
- Cultural Awareness -- Lessees are required to conduct a training program for all personnel, including contractors and subcontractors, involved in any activity. The program must be designed to inform each person working on the project of environmental, social, and cultural concerns which relate to the individual's job. In addition, the program must also be designed to help personnel increase their sensitivity

and understanding of community values, customs, and lifestyles in areas where they will be operating. The program must include an explanation of the applicable laws protecting cultural and historic resources.

- Protection of Historic and Archeological Sites -- Prior to exploration activities involving ground disturbance, and subsequent development, lessees must conduct an archeological inventory. If any objects are discovered at any time, they must be reported, and appropriate protective measures followed.
- Economic Security -- Lessees are encouraged to employ local and Alaska residents and contractors. Plans of Operation must include a prescription for partnering with local communities in recruiting and hiring Alaska residents and contractors. Lessees are advised to bring local residents into their operations planning process. Residents can provide critical input and traditional knowledge to operations and oil spill prevention and response planning. Community representation on management teams facilitate the transfer of information, intentions, and values between lessees and residents.

2. Fish

- Habitat Protection -- Lessees may be required to construct ice and/or snow bridges if ice thickness at a crossing is insufficient to protect the streambed and the stream bank. Any removal of water from fishbearing streams, rivers, and natural lakes requires written approval. When a fishbearing waterbody is used as a water source, lessees must use appropriate measures to avoid entrainment of fish (prevent fish from being drawn into the intake pipe). Lessees must locate, develop, and rehabilitate gravel mine sites in accordance with ADF&G guidelines. All discharges into upland waterbodies must meet state water quality standards. Disposal of produced waters in upland areas is prohibited unless approved by ADEC under 18 AAC 430. Disposal of wastewater, such as domestic greywater, into fresh waterbodies is prohibited. Lessees are advised that permanent, staffed facilities must be sited to the extent feasible and prudent outside identified Dolly Varden (arctic char) overwintering areas.
- Marine Discharge -- Discharge of produced waters into open or ice covered waters less than 10 meters is prohibited. Discharge of muds and cuttings is prohibited shoreward of the 5-meter isobath. For those areas that are greater than 10 meters, the commissioner of ADEC may approve discharges on a case-by case basis. Under the NPDES general permit, discharge is not authorized within 1,000 meters of Stefansson Sound. Discharge is prohibited within 1,000 meters of river mouths or deltas during unstable or broken ice or open water conditions.
- Waterbody Buffers -- Onshore facilities other than docks, or road and pipeline facilities must not be sited within 500 feet of fishbearing streams. Facilities may not be sited within 1/2 mile of the banks of the main channel the Colville, Canning and Sagavanirktok, Kavik, Shavirovik, Kadleroshilik, Echooka, Ivishak, Kuparuk, Toolik, Anaktuvuk and Chandler Rivers. No facility will be sited within 500 feet of all other fishbearing waterbodies. Road and pipeline crossings must be perpendicular to watercourses to prevent buffer erosion. Additionally, facilities may not be sited within one-half mile of identified Dolly Varden both overwintering/spawning areas on the Kavik, Canning and Shavirovik Rivers. Road and pipeline crossings will not be sited within these buffers unless the Director, after consulting ADF&G, determines that such facility restrictions are not feasible or prudent.
- Obstructions to Migration and Movement --Continuous fill causeways are discouraged. Any proposed causeway must be designed, sited, and constructed so as to maintain free passage of marine and anadromous fish, and shall not cause significant changes to nearshore oceanographic circulation patterns and water quality characteristics that result in violations of state water quality standards. Causeways may not be located in river mouths or deltas. Monitoring programs and mitigation, such as breaching, may be required to achieve intended protection objectives.

Activities that may block fish passage in anadromous streams are prohibited. Alteration of riverbanks, except for approved crossings is prohibited. Operation of equipment other than boats in open water areas of rivers and streams is prohibited. If bridges are not feasible, culverts used for stream crossings must be designed, installed, and maintained to provide efficient passage for fish.

- Explosives -- The lessee will consult with the NSB prior to proposing the use of explosives for seismic surveys. The director may approve the use of explosives for seismic surveys after consultation with the NSB.

- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, preparedness, response capability, and cleanup of oil spills. Lining and diking of oil or fuel storage tanks is mandatory, and buffer zones are required to separate oil storage facilities from marine and freshwater supplies.

3. Birds

- Habitat Protection -- Lessees must identify and avoid sensitive habitat areas and site permanent facilities outside of identified brant, white-fronted goose, tundra swan, king eider, Steller's eider, spectacled eider, and yellow-billed loon nesting and brood rearing areas. Permanent facilities must be sited minimum distances from streams and lakes. Lessees must comply with the USF&WS' recommended protection measures for peregrine falcons, and Spectacled eiders during the nesting and brood rearing periods. Lessees are advised to consider identified sensitive bird habitats when planning operations. Lessees shall comply with the Recommended Protection Measures for Steller's eider once they are developed by the USFWS.
- Disturbance -- Lessees are advised that aircraft must avoid identified brant, white-fronted goose, tundra swan, king eider, common eider, and yellow-billed loon nesting and brood rearing habitat, and the fall staging areas for geese, tundra swans, and shorebirds, during critical time periods in summer and fall. NSB Municipal Code (19.70.050(I)(1)) requires that vehicles, vessels, and aircraft that are likely to cause significant disturbance must avoid areas where sensitive species are concentrated. Horizontal and vertical buffers will be required where appropriate.
- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, and cleanup of oil spills. Lining, diking and buffer zones are required to separate oil storage facilities from marine and freshwater supplies.

4. Caribou

- Disturbance -- If development occurs, pipelines must be designed and constructed to accommodate caribou movement and migration patterns. Above-ground pipelines must be elevated a minimum of five feet. Ramps or pipeline burial may be required to facilitate caribou movement.
- Habitat Loss -- Lessees are advised that aircraft should avoid caribou concentrations to ensure access to insect relief and calving habitat. Gravel mining must be limited to the minimum necessary to develop a field efficiently.
- Lessees are advised in planning and design activities to consider the recommendations for oil field design and operations contained in the final report to the Alaska Caribou Steering Committee.

5. Grizzly Bear

- Waste management -- lessees must use appropriate methods of garbage and putrescible waste disposal to minimize attracting bears.
- Habitat protection -- lessees must avoid conducting exploration or development activities in the vicinity of occupied dens, or obtain approval for alternative mitigating measures.
- Avoidance of human/bear conflicts --- lessees are encouraged to prepare bear interaction plans.

6. Muskoxen

- Disturbance -- If development occurs, pipelines must be designed and constructed to accommodate muskoxen movement and migration patterns. Lessees are advised that aircraft should avoid muskoxen concentrations.

7. Arctic and Red Foxes, Wolf, and Wolverine

- Habitat protection -- Exploration facilities must be temporary and must utilize ice roads and pads. Facilities may not be sited within waterbody buffers.
- Waste management -- lessees must use appropriate methods of garbage and putrescible waste disposal to minimize attracting wolves, wolverines, and foxes.

8. Polar Bear

- Lessees are advised they must comply with the provisions of the Marine Mammal Protection Act.
- Disturbance and Habitat protection -- lessees must avoid conducting exploration or development activities in the vicinity of occupied dens. Lessees are advised that certain areas are especially valuable for their concentrations of polar bears and must be considered when developing plans of operation.
- Avoidance of human/bear conflicts -- lessees are encouraged to prepare bear interaction plans.
- Waste management -- lessees must use appropriate methods of garbage and putrescible waste disposal to minimize attracting bears.
- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, and cleanup of oil spills. Lining, diking and buffer zones are required to separate oil storage facilities from marine and freshwater supplies.

9. Pinnipeds

- Oil Spill Prevention and Control -- Lessees are advised they must prepare contingency plans addressing prevention, detection, and cleanup of oil spills. Lining, diking and buffer zones are required to separate oil storage facilities from marine and freshwater supplies.
- Lessees are advised they must comply with the provisions of the Marine Mammal Protection Act.

10. Subsistence Uses

- Animal disruption -- Lessees are advised that interfering with reasonable access to subsistence resources violates the ACMP and NSB Municipal Code. Aircraft should avoid sensitive bird habitat, and vertical and horizontal buffers separating aircraft from waterfowl, caribou, and muskoxen may be required. Identified sensitive habitats must be avoided and potential adverse impacts considered in operations planning.
- Unrestricted access -- No restriction of public access to, or use of, the lease sale area due to oil and gas activity will be permitted, except within the immediate vicinity of drill sites, buildings and other related facilities. Any area of restricted access must be justified in the plan of operations.
- Oil Spill Prevention and Response -- In addition to addressing the prevention, detection, and cleanup of releases of oil, contingency plans (C-Plans) should include methods for detecting, responding to, and controlling blowouts. NSB Municipal Code requires that C-Plans include the location and identification of oil spill cleanup equipment; the location and availability of suitable alternative drilling equipment; a plan of operations to mobilize and drill a relief well; and a risk analysis indicating where oil spills are likely to flow under various sets of meteorological or oceanographic conditions (19.70.050(I)(6-7)).
- Harvest conflict resolution -- lessees must cooperate with agencies and the public to avoid conflicts by selecting alternative sites or implementing seasonal restrictions on certain activities, and by siting permanent facilities a minimum distance from fishbearing waterbodies. Prior to initiating any activity which may disrupt subsistence harvesting, lessees must consult with the affected community before plans of operation may be approved. Plans of Operation must include a discussion of the reasonably foreseeable

effect on subsistence activities of any other operations in the area that lessees know will occur during the lessee's proposed operations. Lease-related use will be restricted when the Director determines it is necessary to prevent unreasonable conflicts with subsistence harvests. The Commissioner of ADNR may assemble affected parties or take other measures to resolve conflicts.

- Community participation -- Lessees are advised to bring local residents into their operations planning process. Residents can provide critical input and traditional knowledge to operations and oil spill prevention and response plans. Community representation on management teams facilitates understanding and the transfer of information between the intentions of the lessee and the values of residents.

11. Historic and Cultural Uses

- Education -- lessees are required to conduct training for all employees and contractors on environmental, social, and cultural concerns in the sale area.
- Protection of historic and archeological sites -- prior to exploration activities involving ground disturbance, and subsequent development, lessees must conduct an archeological inventory. If any objects are discovered at any time, they must be reported, and appropriate protective measures followed.

12. Transportation

- Maintenance of nearshore oceanographic circulation patterns and fish passage -- Continuous fill causeways are discouraged. Any proposed causeway must be designed, sited, and constructed so as to maintain free passage of marine and anadromous fish, and shall not cause significant changes to nearshore oceanographic circulation patterns and water quality characteristics that result in violations of state water quality standards. Causeways may not be located in river mouths or deltas. Monitoring programs and mitigation, such as breaching, may be required to achieve intended protection objectives.

13. Oil Spill Risk, Prevention, and Response

- Oil spill prevention -- Lessees are required to implement oil spill prevention, control, and countermeasures plans (see Chapter Five). In addition, they are required to site facilities away from lakes and streams and critical wetlands, to provide adequate protection for on-site oil storage, and to locate pipelines to facilitate oil spill cleanup.

D. Bidding Methods and Lease Terms

The selection of the bidding method, minimum bid, and term of the lease was made following the department's pre-sale analysis of economic, engineering, geological, and geophysical data. The bidding method selected best secures revenues for the state without creating disincentives to industry.

The bidding method selected for Sale 87 is cash bonus bid. The minimum bid is \$5.00 per acre. There will be a fixed 12-1/2 percent royalty. The initial term is 7 years. There will be no exploration incentive credits for this sale.

E. Summary and Signature

No activity may occur without further review and proper authorization from the appropriate permitting agency and all activities must comply with the NSBCMP and the Alaska Coastal Management Program. When specific activities are proposed, more detailed information such as site, type, and size of facilities will be known, in addition to the historical project data. Except for some very limited types of proprietary information, permit applications are public information and most permitting processes include public comment periods. Additional terms may be imposed in any subsequent permits when applied for if additional issues are identified at that time.

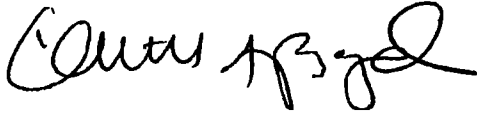
Developing the state's petroleum resources is vital to the state economy and the well being of its citizens. With Sale 87 mitigation measures presented in this final finding imposed on leases and plans of

operation, and additional project-specific and site-specific mitigation measures imposed in response to specific proposals, the petroleum resources of the sale area can most likely be explored and developed without significantly affecting fish and wildlife populations or traditional human uses. The state has sufficient authority from general constitutional, statutory and regulatory empowerments, the terms of the sale, the lease contract, and plan of operations permit terms to ensure that lessees conduct their activities safely and in a manner that protects the integrity of the environment and maintains opportunities for subsistence uses.

On the basis of the facts and issues presented at this time, the foregoing findings, applicable laws and regulations, and the documents reviewed during preparations of this final finding, I conclude, as a final matter, that the potential benefits of the sale, as conditioned, outweigh the possible adverse impacts, and that Oil and Gas Lease Sale 87, North Slope Areawide, will best serve the interests of the state of Alaska.

This Best Interest Finding is a final administrative decision of the department. A person who is aggrieved by this finding may request the commissioner to reconsider the decision under AS 35.05.035(i) and (j). To be eligible an appellant must have meaningfully participated in the process to develop the finding by either submitting written comments during the prescribed comment periods, or by presenting oral testimony at a public hearing regarding the proposed sale. A request for reconsideration must be received by John T. Shively, Commissioner, Department of Natural Resources, 3601 "C" Street, Suite 1210, Anchorage, Alaska 99503-5921, or received by fax at 1-907-269-8918 by 5:00 p.m. (local time), April 6, 1998. If the commissioner fails to act on the request for reconsideration by April 16, 1998, the request is considered denied.

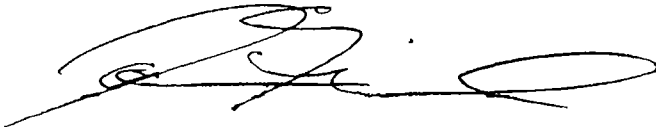
A denial of a request for reconsideration is the final administrative decision for purposes of appeal to Superior Court. A person may appeal the Final Best Interest Finding to Superior Court only if the person was eligible to request, and did request, an administrative reconsideration of the finding by the commissioner. An appellant must initiate an appeal to the Superior Court within 30 days from the date of denial of that reconsideration or from the date of distribution of the denial decision, in accordance with the rules of court and to the extent permitted by applicable law.



Kenneth A. Boyd
Director

March 17, 1998

I concur with the decision of the director that Sale 87 is in the best interests of the state.



John T. Shively
Commissioner

March 17, 1998

Appendix A: Comments and Responses

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Appendix A. Comments and Responses

1. Comments on the Preliminary Best Interest Finding

This section of the appendix includes a summary of comments regarding Sale 87, North Slope Areawide Preliminary Best Interest Finding, and the ADNR response to those comments.

Index of comments received following the Preliminary Best Interest Finding

Date	Organization	Author	Origin
9/16/97	(RA)	Rosemary Ahtuanguaruak	Nuiqsut
10/6/97	Anadarko Petroleum Corporation (ADK)	Todd L. Liebl	Anchorage
10/17/97	Arco Alaska Inc. (ARCO)	Michael A. Richter	Anchorage
10/20/97	ADF&G, Habitat & Restoration Division (ADF&G)	Alvin A. Ott	Fairbanks
10/20/97	Alaska Oil and Gas Association (AOGA)	Judith M. Brady	Anchorage
10/20/97	BP Exploration (Alaska) Inc. (BPX)	E.P. Zselezcky	Anchorage
10/20/97	North Slope Borough, Mayor's Office (NSB)	Benjamin P. Nageak	Barrow
10/20/97	Northern Alaska Environmental Center, Alaska Center for the Environment, Greenpeace, Oilwatch Alaska (NAGO)	Sara Callaghan, Kevin Harun, Melanie Duchin, Jim Sykes	Anchorage
10/20/97	US Fish & Wildlife Service (FWS)	Patrick J. Sousa	Fairbanks
11/5/97	City of Nuiqsut	Rosemary Ahtuanguaruak	Nuiqsut
12/4/97	North Slope Borough, Mayor's Office (NSB)	Benjamin P. Nageak	Barrow
12/4/97	Alaska Eskimo Whaling Commission	Maggie Ahmaogak	Barrow
12/5/97	Trustees for Alaska	Peter Van Tuyn	Anchorage

The following comments respond to the Sale 87 Preliminary Best Interest Finding. Many comments pertain specifically to mitigation measures, formerly called lease sale stipulations or plan of operations permit terms. Other comments raise issues of concern regarding this areawide lease sale. Major issues considered material to the Director's decision are presented in Chapter Seven along with a complete list of mitigation measures and lessee advisories. Issues are addressed in this appendix and references to applicable mitigation measures and text are provided in the following responses.

All comments have been considered carefully. Mitigation measures and lessee advisories in place for this sale represent consensus reached among state resource agencies (ADNR, ADF&G, ADEC) and the North Slope Borough during the ACMP consistency determination process. Prior to each annual sale, ADNR will request new and significant information that has become available since the previous lease sale. Based on this information, ADNR may supplement the finding prior to holding the next annual sale. New information could result in the inclusion of additional mitigation measures. Sale 87 is scheduled to be held in June 24, 1998. The current leasing schedule calls for other North Slope areawide sales to be held each February in 1999, 2000, and 2001.

State Agencies

<p>ADF&G, Habitat & Restoration Division, Alvin A. Ott, 10/20/97</p>	
<p>Recommends there be no surface occupancy within one-half mile of identified Dolly Varden overwintering and spawning areas in the Sale 87 area. Streams containing known Dolly Varden overwintering and spawning areas include the Kavik, Canning, and Shaviovik Rivers. Exploration and development in these discrete areas may adversely affect the water quality or quantity necessary to ensure continued survival of Dolly Varden populations in these areas.</p>	<p>To protect Dolly Varden overwintering and spawning habitat, measure 21 has been modified by adding a new paragraph: b. No facilities will be sited within one-half mile of identified Dolly Varden both overwintering/spawning areas on the Kavik, Canning and Shaviovik Rivers. Road and pipeline crossings will not be sited within these buffers unless the Director, after consulting ADF&G, determines that such facility restrictions are not feasible or prudent.</p>
<p>Not all streams on the North Slope have been adequately surveyed to determine Dolly Varden presence, nor is the full extent of the distribution of their spawning and overwintering areas known. Should additional spawning or overwintering areas be discovered within the lease area, the department will request the no surface occupancy provision be applied to these areas during plan of operations review.</p>	<p>Comment noted.</p>
<p>Steller's Eider should be added to the Lessee Advisory 5a, as it has been recently added to the list of threatened and endangered species.</p>	<p>The following language has been added to Lessee Advisory 5a: "Lessees shall comply with the Recommended Protection Measures for Steller's Eider once they are developed by the USFWS."</p>
<p>Mitigation Measure 9 should be modified to exclude the development of mine sites and use of gravel for exploration purposes. The measure should be updated to reflect the current oilfield practice of using ice pads and ice roads for exploration.</p>	<p>Current operating practices on the North Slope are to avoid gravel mining in support of exploration. DO&G supports this approach. However, DO&G does not want to totally eliminate gravel mining in support of exploration as a possible option.</p>

Federal Agencies

<p>US Fish & Wildlife Service, Northern Alaska Ecological Services, Patrick J. Sousa, 10/20/97</p>	
<p>Concerned about the Arctic National Wildlife Refuge. The Arctic Refuge Comprehensive Conservation Plan prohibits development of oil and gas support facilities on the Refuge. Potential lessees should be clearly informed that oil and gas exploration and development, or any associated infrastructure, is not authorized on adjacent Refuge lands.</p>	<p>Comment noted. The Arctic National Wildlife Refuge is outside of the Sale 87 area.</p>

Appendix A: Comments and Responses

<p>The following comments pertain to our comments submitted to the DO&G, dated February 28, 1997: Although ADNR has referenced the literature regarding Central Arctic Herd calving success, the request to delete critical calving and post-calving areas was apparently not considered.</p>	<p>Calving and post-calving areas appear to change location over time. Deletion of these areas today may not be relevant in the future when leases are likely to be developed. Furthermore, DO&G does not believe that any tract deletions are necessary. Sale 87 measures and lessee advisories, and the opportunity to impose additional restrictions during plan of operations review, provide sufficient protection for critical caribou calving and post-calving areas.</p>
<p>Identification of "key wetlands" is inadequate. Although ADNR did identify key wetlands as "those wetlands that are important to fish, waterfowl, and shorebirds because of their high value or scarcity in the region" (see page 7-3), categories of wetlands should be clarified.</p>	<p>Several Sale 87 measures protect wetland habitats. Some wetland classifications are discussed in Chapter Three. Key wetlands are identified at the project proposal phase after initial habitat surveys and wildlife studies are complete. ADF&G, USFWS, COE, EPA, and NOAA identify sensitive habitats and natural resources at that time and ensure that they will be protected. Lessee Advisory 3 states that the wetlands referred to in Mitigation Measures 5, and 19 are based on a classification system developed by Bergman et al (USF&WS Resource Publication 129, 1977 Waterbirds and Their Wetland Resources in Relation to Oil Development at Storkersen Point, Alaska). Lessees are also advised that the state may adopt or approve the use of an alternative wetlands classification system in the future, however, the protective nature of the wetlands mitigation measures developed for this and other oil and gas lease sales will remain consistent regardless of the wetlands classification ultimately selected.</p>
<p>As previously requested, Measure 5 should be revised to include a requirement that facilities sited in key wetlands "will be sited, designed, constructed, and maintained in a manner that will preserve natural hydrological patterns." This revision was not incorporated into the preliminary finding. Lessees should be required to follow best-construction methods to ensure the maintenance of cross drainage and sheet flow in all wetlands (not just streams) on the Arctic Coastal Plain.</p>	<p>First, all operators, regardless of the lease, are required to use the best methods available. Second, lease sale measures must be written so as to be flexible enough to accommodate change. Sale 87 must be consistent with the ACMP, and 6 AAC 80.130 requires that wetlands and tideflats be managed so as to assure adequate water flow, nutrients, and oxygen levels and avoid adverse effects on natural drainage patterns, the destruction of important habitat, and the discharge of toxic substances. Best construction practices are considered at the plan of operations stage, when specific activities or facilities are proposed for specific sites.</p>
<p>ADNR did not further evaluate our recommendation (from Sale 80) that lessees consider aerial surveys of a proposed development area to determine the local status of the threatened Spectacled eider. This is unfortunate because these surveys are both cost-effective (relative to expensive ground surveys) and critical relative to defining the aerial extent of breeding.</p>	<p>This proposed change is unnecessary. Determination of the local status of spectacled eider and other threatened or endangered species is done at the project proposal phase as required by the Endangered Species Act.</p>

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<p>Regarding the discussion of Meehan and Jennings (page 3-3), what is meant by “key bird species,” i.e., is this based on numbers, economic value, or subsistence value? Suggest review and incorporation of Derksen et al. 1981 (Use of wetland habitats by birds in the National Petroleum Reserve-Alaska. U.S. DOI, FWS, Resource Publication No. 141, Washington).</p>	<p>Key bird species are defined by state and federal agencies during the permit application and approval process at the plan of operations permit phase. Determinations are based on all the cited values: for their value to the ecosystem, and for their economic and subsistence value. Although NPRA is outside of the Sale 87 region, DO&G is reviewing the referenced publication for data that may be applicable to the sale area.</p>
<p>The Nelchina caribou herd was not defined relative to other caribou herds on page 3-13. How does this herd relate to the CAH on which comparisons are based?</p>	<p>The Nelchina herd was used as an example to illustrate the concept of carrying capacity, and the reality posed to wildlife managers. Carrying capacity is the maximum herd size that a given geographic range can support. Without controlled harvesting, grazing or foraging herds can overpopulate their range in times when conditions are good and food is abundant. Severe winters, deep snow, delayed spring thaw, or bad insect years can reduce calving success. Reduced calving success, coupled with mortality from starvation and increased numbers of predators, can cause the size of a herd to drop sharply. Fish and shellfish populations are also subject to population “crashes.”</p>
<p>The spectacled eider should be added to the list of species identified in Mitigation Measure 19.</p>	<p>The spectacled eider and Steller’s eider have been added to the list of species in measure 19.</p>

Local Government

Rosemary Ahtuanguaruak, 9/16/97

Proposed Sale 87 is detrimental to the people of Nuiqsut. The many animals of the land and sea will suffer excessively from stresses exerted upon them by oil and gas development. The sensitive ecosystem has had studies done to prove development can occur, but the dwindling numbers of animals in the region proves the harm.

While the community of Nuiqsut may experience acute impacts associated with development, such as impacts from the Alpine Development Project, adverse effects on fish, wildlife and their habitats and human uses are not expected to be long-term. Nuiqsut is likely to also experience positive impacts of development in the form of job opportunities and revenues and services provided by the NSB (which receives about \$225 million annually in oil and gas property taxes). In addition to NSB municipal code, ACMP reviews, and federal wildlife protection laws, mitigation measures ensure that natural resource values will be maintained. Nuiqsut residents have reported recent declines in moose and fish abundance. DO&G has not found any evidence linking oil and gas activities to declining numbers of North Slope wildlife populations. Additionally, animal populations commonly rise and fall in natural cycles.

As a balancing agency, DO&G believes that oil and gas development can occur in a manner that will protect the ecosystem and the people of Nuiqsut. The best interest finding recognizes the extraordinary environmental values of the North Slope. In addition to NSB municipal code, ACMP reviews, and federal wildlife protection laws, mitigation measures ensure that natural resource values will be maintained. Virtually all of Sale 87 mitigation measures have been designed to reduce stress on area fish and wildlife resources and habitats, as well as subsistence hunting and fishing.

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<p>The lives that will be greatest affected are the few living year-round. The only benefit will be the mighty dollar that will go to the state and the impact will be felt by the few people whose faces you'll never see and cries of hunger you'll never hear. Impact funds will not be earmarked for us. When our natural food sources have moved away due to the impact, who will listen and get us the help we already have demonstrated that we need as a result of existing development?</p>	<p>ADNR agrees that effects of development projects would be felt most by local year-round residents. The state does not expect post-Sale 87 activities to result in population declines of subsistence resources, nor is it likely that post-sale activities will affect behavior and migration patterns of sale area wildlife resources. Numerous mitigation measures have been imposed to ensure maintenance of fish and wildlife populations as well as subsistence opportunities. Benefits from lease sale development include potential employment opportunities and possible increases in corporate dividends and Alaska Permanent Fund dividends. As noted above, the NSB receives substantial revenues from tax assessments on oil and gas property. Public services supplied by the NSB are made possible via oil and gas property taxes. Additionally, the NSB municipalities receive funding and program support from the state.</p> <p>Impact funds are petroleum-derived revenues set aside by Congress or the state legislature for communities experiencing direct impacts of leasing. For example, under a program created by the legislature in 1986, a portion of revenues derived from leasing efforts in the NPRA are set aside for NSB communities directly impacted by NPRA leasing. This program is administered by ADC&RA. There is presently no impact fund program associated with the state leasing program. Such a program could be created by the legislature, private industry sources, federal sources, or a combination.</p>
<p>When development does occur and jobs are out of reach of our residents, as most of the jobs have been, what are we to do to provide for our families without the land and sea?</p>	<p>Holding the lease sale does not necessarily mean that exploration and development will automatically follow, and, in the event exploration and development does take place, ADNR aims to protect the environment through the enforcement of carefully thought-out mitigation measures, laws and regulations. Municipalities and boroughs also use a consensus process to draft development guidelines into local ordinance. The resources of the land and the sea will continue to be available to the people who depend upon them. In addition, the state, through Mitigation Measure 13, attempts to ensure that residents get are considered for jobs by encouraging prospective lessees to hire local and Alaska residents and contractors for work performed in the lease area. Many companies have programs to provide training in skills applicable to working in the oil industry.</p>

<p>North Slope Borough, Office of the Mayor, Benjamin P. Nageak, 10/20/97</p>	
<p>The NSB is generally supportive of the concept of areawide leasing as a means to reduce the burden of continually reviewing a patchwork of non-contiguous areas proposed for lease within a larger region. However, as stated in the Borough's 1996 comments, the interval between repetitive lease sales should be greater than one year, and the interval of 10 years between best interest findings is too great.</p>	<p>The areawide leasing bill that was unanimously passed by the legislature allows lease sales to be held each year, and allows an interval of ten years between best interest findings. However, ADNR will issue a call for new information every year, and if substantial new information is indicated, will revisit the best interest finding process. The call for new information will be sent to the North Slope mailing list, which includes the NSB and other communities as well as the public.</p>
<p>With a proposed sale area of such great size, and given that this could be the only comprehensive best interest finding developed for the area over the next ten years, the state appears to have made only the minimum efforts required to involve the North Slope public in the decision-making process. In preparation for the first Cook Inlet Areawide sale, the state convened a stakeholders task force to assist in the development of that sale's preliminary finding. No similar group of local residents was formed to contribute to the development of the Sale 87 preliminary finding, and no formal or informal North Slope community public meetings of any kind have been held to discuss this new leasing process. A single informational meeting was scheduled in Nuiqsut on October 9th, but has been rescheduled for November 13th, after the close of the comment period on the preliminary finding. Though the state acknowledges that post-lease sale 87 activities could affect subsistence in Nuiqsut, Barrow, Kaktovik, and perhaps Anaktuvuk Pass, only the single informational meeting in Nuiqsut has been scheduled. Recommends that the state hold hearings and take public testimony in the North Slope communities of Nuiqsut, barrow, Kaktovik, and Anaktuvuk Pass before a final best interest finding is prepared.</p>	<p>The Cook Inlet Stakeholders' process was an experiment and was not intended to be utilized for all lease sales. ADNR made a substantial effort to schedule a public meeting/teleconference for Sale 87. This meeting was to be held in Nuiqsut, with teleconferences to Barrow, Kaktovik and Anaktuvuk Pass. The meeting was originally scheduled for October 9, 1997, but had to be postponed until November 13 because the commissioner of ADNR was very ill. The November 13 meeting was cancelled following a tragic airplane crash in Barrow on November 9. Because of the commissioner's schedule, and upcoming holidays, ADNR suggested a meeting on December 3 or 4. This conflicted with a Kuukpik Corporation retreat. With village leaders absent, the commissioner decided it was best not to schedule a meeting at that time. Because ADNR could not schedule a meeting date all parties could agree to, it extended the public comment period for Sale 87.</p>
<p>Concerned with the use of explosives in connection with industrial activities on the North Slope. Residents have repeatedly testified about the lethal or otherwise harmful effects of explosives they have observed on the area's fish and wildlife. We had expressed this concern during other recently proposed lease sales, and felt confident that given the willingness of industry representatives to concede that they had no intention of using explosives in their operations, the state would ban their use. Nowhere in the document is a justification or explanation provided for the continued use of explosives in connection with seismic or other industry operations. The borough renews its recommendation that the use of explosives be prohibited.</p>	<p>As a result of the NSB's elevation of this issue, mitigation measure 1 has been modified to require lessees to consult with the NSB prior to proposing the use of explosives for seismic surveys. The director may approve the use of explosives for seismic surveys after consulting with the NSB. The discussion of explosives in the best interest finding has been expanded (See Chapter 5).</p>

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<p>Though Mitigation Measure 14a offers protection for bowhead whales and minimizes disruption of subsistence activities, the whale, its use of offshore areas adjacent to the proposed sale area, and subsistence whaling are not adequately discussed in the document.</p>	<p>A discussion of subsistence whaling has been added to Chapter Four of the finding. As noted in Chapter 5, Sale 87 is expected to have little or no effect on subsistence whaling. Subsistence whaling issues will be addressed in the upcoming proposed Beaufort Sea areawide sale.</p>
<p>Page 4-2 of the preliminary finding should more accurately describe the NSB and its communities. Communities other than Barrow within its borders are Point Hope, Point Lay, Wainwright, Atqasuk, Nuiqsut, Kaktovik, and Anaktuvuk Pass. Deadhorse should be described as an industry support community distinct in nature from our villages. Also, it is misleading to imply on page 4-3 that dogsleds are a widely used means of transportation in winter.</p>	<p>Comment appreciated. The finding has been amended.</p>

In recent years the state has professed a desire to work with the Minerals Management Service to develop mitigation measures which are consistent across state and federal jurisdictions. In keeping with this desire, the borough recommends the state adopt for Sale 87 a mitigation measure similar to MMS Sale 170 Stipulation No. 5. This stipulation requires that a lessee show in its exploration or development and production plan how its activities in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities.

As a result of the Sale 86 (Central Beaufort Sea) ACMP process, mitigation measure 14 was modified to include language contained in MMS Sale 170 Stipulation No. 5. This measure was again modified to fit the Sale 87 area. The NSB elevated this issue, and proposed additional language. A consensus was reached among the resource agencies and the NSB, and measure 14 has been amended as follows as a result:

14. a. Exploration, development or production operations shall be conducted in a manner that prevents unreasonable conflicts between lease related activities and subsistence activities. In enforcing this mitigation measure the division, during review of plans of operation, will work with other agencies and the public to assure that potential conflicts are identified and avoided to the fullest extent possible. Available options include alternative site selection, requiring directional drilling, seismic and threshold depth restrictions, subsea completion techniques, seasonal drilling restrictions, and the use of other technologies deemed appropriate by the Director.
- b. Prior to submitting a plan of operations for both onshore and offshore activities which have the potential to disrupt subsistence activities, the lessee shall consult with the potentially affected subsistence communities and the North Slope Borough (NSB) (collectively "parties) to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures which could be implemented by the operator to prevent unreasonable conflicts. The parties shall also discuss the reasonably foreseeable effect on subsistence activities of any other operations in the area that they know will occur during the lessee's proposed operations. Through this consultation, the lessee shall make reasonable efforts to assure that exploration, development, and production activities are compatible with subsistence hunting and fishing activities and will not result in unreasonable interference with subsistence harvests.
- c. A discussion of resolutions reached or not reached during the consultation process and plans for continued consultation shall be included in the plan of operations. The lessee shall identify who participated in the consultation and send copies of the plan to participating communities and the NSB when it is submitted to the division.

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	<ul style="list-style-type: none"> d. If the parties cannot agree, then any of them may request the commissioner of DNR or his designee to assemble the parties. The commissioner may assemble the parties or take other measures to resolve conflicts among the parties. e. The lessee shall notify the director of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns. f. Lease-related use will be restricted when the Director determines it is necessary to prevent unreasonable conflicts with subsistence harvests.
<p>Nuiqsut residents' concern over the increasing incidence of respiratory disorders in that community in recent years is not adequately discussed in the finding. Residents report occasional emission clouds moving in the direction of the community. The final finding should discuss in appropriate detail the potential effects of periodic air emissions from the oil fields, including natural gas emissions and flares, especially on Nuiqsut.</p>	<p>Air quality throughout the proposed sale area is very good, with concentrations of regulated pollutants well below the maximum allowed under National Ambient Air Quality Standards designed to protect human health. In order to ensure that air quality standards are maintained, additional limitations on nitrogen dioxide, sulfur dioxide, and total-suspended-particulate matter are imposed on industrial sources under the provisions of the Prevention of Significant Deterioration Program, administered by EPA. Most atmospheric contaminants do not originate in the Arctic, but likely result from long-range transport from lower latitudes. ADEC's Air Quality Maintenance program controls significant, stationary sources of air contaminants to protect and enhance air quality and abate impacts on public health and the environment. The agency issues operating permits to existing major facilities incorporating all applicable requirements, and issues construction permits to new large facilities and for expansions of existing facilities.</p> <p>Reasonably foreseeable cumulative effects of this sale on air quality is discussed in Chapter Five. Additional information on impacts to air quality has been added to the finding.</p>
<p>On page 5-15, there should be some discussion of the potential impacts of single and multi-season ice road crossings of rivers and streams, particularly relating to bank erosion.</p>	<p>Erosion rates vary widely from crossing to crossing and DO&G does not feel that a more detailed discussion in the finding would affect the balance of the document at this time. Ice road construction is authorized under the ACMP general concurrence (GC) list. This list establishes certain common activities as consistent with the ACMP. Under GC-34, all rehabilitation shall be completed to the satisfaction of ADNR or the applicable land manager. Rehabilitation shall be completed with full consideration of technical guidance provided by the Division of Agriculture, Plant Material Center.</p>

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<p>The state has determined that its review of proposed Sale 87 will be a multi-phased development review. In other words, the Division of Oil and Gas director has limited his analysis solely to the potential effects of the lease sale phase of oil and gas activities, as opposed to the exploration and development/production phases.</p>	<p>State law allows for a phased review of oil and gas lease sales and the analysis in the best interest finding is premised upon that. The analysis assumes that there will be additional reviews at subsequent phases. However, the scope of the best interest finding is not limited to effects of just leasing. Analysis of effects of subsequent phases including exploration are discussed in Chapter Five.</p> <p>Phased review recognizes that leasing of state land may result in future proposals that cannot be predicted or planned with any certainty or specificity at the initial lease sale stage. Development or production of leases will require future detailed site-specific reviews prior to approval. Prior to an oil and gas lease sale, it cannot be known if, when, where, how, or what kind of development might ultimately occur. Advances in technology and market changes are unpredictable, yet they still affect leasing, exploration, and development decisions (and therefore effects). The lease sale phase only authorizes the transfer of mineral interests, but some level of exploration is expected. At this phase there is no specific proposed exploration or development project. The state has analyzed the reasonably foreseeable effects of exploration, development, production and transportation and has developed mitigation measures to protect valued resources and their human uses.</p> <p>Speculation concerning future development activities that will be subject to independent permitting requirements is not prudent at the time a decision is made to lease. Furthermore, state law specifically states that the director may not be required to speculate about possible future effects subject to future permitting that cannot reasonably be determined until the project or proposed use is more specifically defined. This includes speculation about the exact location and size of facilities, the economic feasibility of ultimate development, and future environmental or other laws that may apply at the time of any future development (AS 38.05.035(h)).</p>
<p>We are concerned with the issue of cumulative impacts and the way the state chooses to administer the coastal program within this new areawide framework. The Borough will demand a comprehensive consistency review of any annual areawide reoffering, which takes into account ongoing or proposed exploration and development activities, as the pattern of those activities becomes less speculative with successive lease sales.</p>	<p>A consistency review at the lease sale stage does not deal with ongoing or proposed exploration and development activities because each project or permit includes multi-agency consistency reviews. Measure 14 requires lessees, the NSB and potentially affected subsistence communities to discuss the reasonably foreseeable effect on subsistence activities of any other operations in the area that they know will occur during the lessee's proposed operations. This measure represents consensus reached by state resource agencies and the NSB that Sale 87 is consistent with the ACMP and NSB coastal district plan.</p>

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<p>It is unreasonable to claim at the leasing phase that it is speculative to consider exploration and development scenarios, and then assert in reviews of individual exploration and development proposals that only project-specific potential effects can be considered in the analysis.</p>	<p>While ADNR maintains that it would be speculation to consider hypothetical exploration and development scenarios at the lease sale phase, it does not assert that only project-specific potential effects be considered at the plan of operations or development proposal phase. To the contrary, ADNR encourages plan of operations analyses to be as comprehensive as possible. For example, there is concern that future lease activities will conflict with traditional harvesting. To avoid unreasonable conflicts with subsistence harvesting, mitigation measure 14 requires lessees to include in their plan of operations a discussion of the reasonably foreseeable effect on subsistence activities of any other operations in the area that they know will occur during the lessee's proposed operations. Regulations stipulate that prior to approval, a plan of operations must contain sufficient information, based on data reasonably obtainable, 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 (11 AAC 83.158(d)). The ADNR commissioner may amend plans as necessary to protect the state's interest.</p> <p>Indirect, additive or cumulative effects are by definition not direct effects. Under this regulation, there is therefore no requirement for a cumulative effects analysis (beyond the project being proposed) at the Plan of Operations permit review.</p>
<p>Recommends that the state expand its communication and consultation with the North Slope public before finalizing its plans for conducting this first areawide sale.</p>	<p>ADNR Commissioner Shively has had additional communication and consultation with the NSB regarding this sale. Mitigation measure 14 has been modified (see above) to improve communications between potentially affected communities, industry, and the state prior to operations approval. If problems between industry and subsistence users cannot be resolved after the consultation process, then any party involved may request the commissioner of DNR or his designee to assemble the parties. The commissioner may assemble the parties or take other measures to resolve conflicts among the parties.</p>

<p>City of Nuiqsut, Rosemary Ahtuanguaruk, 11/5/97</p>	
<p>The extreme cost of living in the Arctic puts many food staples out of reach to many families. The animals are seasonal and their habitat has been encroached upon over the years. The effects of the seismic activities do harm the bowhead migration path forcing our whalers to travel further to harvest. The fish are affected by the causeways and we have not had them to supplement our diets. The community has gone hungry in the past when the natural habitat is changed forcing the animals away. Our traditional resources are being threatened by this lease sale.</p>	<p>As a balancing agency, DO&G believes that oil and gas development can occur in a manner that will protect the ecosystem and the people of Nuiqsut. Virtually all of Sale 87's mitigation measures have been designed to protect fish and wildlife resources and habitats, as well as the subsistence hunting and fishing. The best interest finding recognizes the extraordinary environmental values of the North Slope and describes measures that will be implemented to mitigate against potential adverse impacts.</p>
<p>There must be a system that develops a board of local people that allows our community to be consulted.</p>	<p>Measure 14 has been rewritten to reflect a consensus reached among state agencies and the NSB during a director-level elevation. The term requires lessees to consult with potentially affected subsistence communities and the NSB before submitting a plan of operations, which is equivalent to a permit application. Lessees must discuss these consultations in the plan of operations they submit to DO&G for permit approval. They must also notify the director of DO&G of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns.</p>
<p>When the various activities are doled out to the subcontractors and there are breaks in the guidelines, who can we bring our concerns to?</p>	<p>Measure 12 requires lessees to have a training program for all personnel, including contractors and subcontractors, that addresses the need to protect the environment and cultural and historic resources. They are also required to help personnel increase their sensitivity to community values, customs, and lifestyles. Measure 13 encourages lessees to employ local and Alaska residents and contractors. Their plans of operation must include proposals detailing the means by which they will comply with this requirement. They must include a description of their plans for partnering with local communities to recruit and hire local residents. Plans of operation are "permits" issued by DO&G before any activities can take place on a lease. If you and the people of Nuiqsut believe there have been breaks in the guidelines, you can contact the director of DO&G.</p>
<p>We have seen an increase in asthma in our community of up to 400% and thyroid disorders of 800%. What has caused this? Is this problem related to developing petroleum reserves? Should we expect an increase in breast cancer?</p>	<p>Increases in asthma and thyroid disorders are serious, but it is beyond the expertise of DO&G to determine their causes. Likewise, DO&G cannot advise whether residents of Nuiqsut can expect an increase in breast cancer as a result of oil and gas development. However, we have developed a new lessee advisory number twelve, which encourages lessees to adopt conservation measures to reduce hydrocarbon emissions.</p>

<p>We are seeing severe weather changes related to global warming. What should we do to stop this development and prevent worsening the global warming? The oil is running out and soon there won't be any to develop. Do we have to get all of it for the few greedy politicians to line their pockets with? Understand that our life will never be the same and severe hardships are due us if this sale is allowed to happen.</p>	<p>While there is recognition that global warming is occurring, there is no agreement as to its causes. DO&G cannot state that global warming is being caused by oil and gas development, and DO&G is not required to do an evaluation of global warming theories in order to determine that Sale 87 is in the state's best interest. However, we have developed a new lessee advisory (12) which says the state recognizes that in the long run sources of energy other than oil and gas will be needed, and that we will appreciate lessee participation in conducting research on alternative energy sources.</p>
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North Slope Borough, Benjamin Nageak, 12/4/97

<p>The NSB appeals the best interest finding because there were no public meetings held in the affected communities. DO&G instead tried to accommodate only one informational meeting at Nuiqsut and teleconference in Atqasuk, Anaktuvuk Pass, Kaktovik and Barrow. Written public notices in English are not well understood. The best interest finding fails to fully address the borough's concerns about use of explosives, marine mammals, cumulative and secondary impacts and the effects on air quality.</p>	<p>ADNR made a substantial effort to schedule a public meeting/teleconference for Sale 87. This meeting was to be held in Nuiqsut, with teleconferences to Barrow, Kaktovik and Anaktuvuk Pass. The meeting was originally scheduled for October 9, 1997, but had to be postponed until November 13 because the commissioner of ADNR was very ill. The November 13 meeting was cancelled following a tragic airplane crash in Barrow on November 9. Because of the commissioner's schedule, and upcoming holidays, ADNR suggested a meeting on December 3 or 4. This conflicted with a Kuukpik Corporation retreat. With village leaders absent, the commissioner decided it was best not to schedule a meeting at that time. Because ADNR could not schedule a meeting date all parties could agree to, it extended the public comment period for Sale 87.</p>
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The NSB elevates the proposed consistency determination because there were no public meetings held in the affected communities. If DO&G had held public meetings they would have heard concerns about the cumulative impact oil and gas development has already had on the Inupiat. The NSB does not believe DO&G has met the requirement to give due deference and hear our concerns as specified under 6 AAC 50.120(a). The elevation is centered on mitigation measures 1 and 14. The borough proposed alternate language for these two terms.

The NSB elevation of the proposed consistency determination resulted in the following changes to mitigation measures 1 and 14:

1. a. Explosives must not be detonated within, beneath, or in close proximity to fishbearing waters if the detonation of the explosive produces a pressure rise in the waterbody greater than 2.5 pounds per square inch (psi) unless the waterbody, including its substrate, is solidly frozen.

Explosives must not produce a peak particle velocity greater than 0.5 inches per second (ips) in a spawning bed during the early stages of egg incubation. The minimum acceptable offset from fishbearing streams and lakes for various size buried charges is:

1 pound charge	37 feet
2 pound charge	52 feet
5 pound charge	82 feet
10 pound charge	116 feet
25 pound charge	184 feet
100 pound charge	368 feet

Specific information on the location of fishbearing waterbodies may be obtained by contacting ADF&G.

b. The lessee will consult with the NSB prior to proposing the use of explosives for seismic surveys. The director may approve the use of explosives for seismic surveys after consultation with the NSB.

14. a. Exploration, development or production operations shall be conducted in a manner that prevents unreasonable conflicts between lease related activities and subsistence activities. In enforcing this mitigation measure the division, during review of plans of operation, will work with other agencies and the public to assure that potential conflicts are identified and avoided to the fullest extent possible. Available options include alternative site selection, requiring directional drilling, seismic and threshold depth restrictions, subsea completion techniques, seasonal drilling restrictions, and the use of other technologies deemed appropriate by the Director.

	<ul style="list-style-type: none">b. Prior to submitting a plan of operations for both onshore and offshore activities which have the potential to disrupt subsistence activities, the lessee shall consult with the potentially affected subsistence communities and the North Slope Borough (NSB) (collectively "parties) to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures which could be implemented by the operator to prevent unreasonable conflicts. The parties shall also discuss the reasonably foreseeable effect on subsistence activities of any other operations in the area that they know will occur during the lessee's proposed operations. Through this consultation, the lessee shall make reasonable efforts to assure that exploration, development, and production activities are compatible with subsistence hunting and fishing activities and will not result in unreasonable interference with subsistence harvests.c. A discussion of resolutions reached or not reached during the consultation process and plans for continued consultation shall be included in the plan of operations. The lessee shall identify who participated in the consultation and send copies of the plan to participating communities and the NSB when it is submitted to the division.d. If the parties cannot agree, then any of them may request the commissioner of DNR or his designee to assemble the parties. The commissioner may assemble the parties or take other measures to resolve conflicts among the parties.e. The lessee shall notify the director of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns.f. Lease-related use will be restricted when the Director determines it is necessary to prevent unreasonable conflicts with subsistence harvests.
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Oil and Support Service Industries

Anadarko Petroleum Corporation, Todd L. Liebl, 10/6/97	
<p>Supports areawide leasing for the North Slope and Cook Inlet. Sale 87 and subsequent sales will provide industry with dependable and frequent opportunity to obtain oil and gas leases necessary to allow investment required for oil and gas exploration.</p>	<p>Areawide leasing allows for thorough region-wide analysis; eliminates confusing requests to the public; and increases government efficiency. Areawide leasing helps Alaska compete in the world market for oil and gas exploration activity. An annual leasing schedule that offers predetermined areas allows industry to plan their exploration strategies years in advance. This increases the likelihood of future exploration dollars being committed to Alaska.</p>
<p>Industry has demonstrated its ability to operate on the North Slope in a safe manner with minimal environmental impact. Technological advancements further reduce the impacts of future exploration and production operations.</p>	<p>Driven in part by environmental awareness, technological advancements have reduced the impacts of oil and gas activities on nature. Current methods are described in Chapter Two. Potential effects of oil and gas activities on fish and wildlife, and their habitats and human uses are discussed in Chapter Five.</p>
Arco Alaska Inc., Michael A. Richter, 10/17/97	
<p>Supports regularly scheduled and predictable lease sales. Encourages ADNR to hold areawide sales on an annual basis.</p>	<p>The areawide leasing program allows the state to more efficiently analyze and offer state lands for lease on a regular schedule, eliminates repeated, confusing requests for review to the public and helps Alaska compete for effectively in the world market for oil and gas exploration activity. Prior to each annual sale, ADNR will request new and significant information that has come available since the previous lease sale. Based on this information, ADNR may supplement the finding prior to holding the next annual sale. New information could result in the inclusion of additional mitigation measures or the removal of certain areas from leasing. Sale 87 is scheduled to be held in June 1998. The current leasing schedule calls for other North Slope areawide sales to be held each February in 1999, 2000, and 2001. Areawide sales in other areas of the state are scheduled in a similar regular manner.</p>
<p>Recommends that ADNR not decrease the aerial surface extent of proposed Sale 87. Arbitrary and unforeseen reductions in the size of the area make it difficult for industry to dedicate the time, personnel and other resources necessary to evaluate the sale area.</p>	<p>ADNR has not reduced the aerial extent of Sale 87. Mitigation measures have been designed to provide protection for sensitive areas so that it would not be necessary to delete areas from the sale area.</p>

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<p>Recommends that leases have a fixed twelve and one-half percent (12.5%) royalty rate. Operators can anticipate prospects covered by Sale 87 will have smaller potential reserve sizes. Smaller prospects may require access to existing facilities and infrastructure to economically justify any exploration. The fixed royalty rate of 12.5 percent will reduce the minimum economic reserve size required for each prospect such that industry can justifiably drill these smaller prospects. The rate will also encourage the development of a greater number of smaller discoveries that collectively will increase the amount of royalties paid to the state. Also suggests the state offer leases with a minimum of seven (7) year primary term, so that successful bidders will have sufficient time to conduct seismic surveys and exploratory drilling, given the short operating season and lengthy permitting process.</p>	<p>Chapter Eight of this Finding contains an analysis of the leasing methods and terms. The selection of the bidding method, minimum bid, and term of the lease was made following the department's pre-sale analysis of economic, engineering, geological, and geophysical data. The bidding method selected was one that best secures revenues for the state without creating disincentives to industry.</p>
<p>Have serious concerns about increased operational restrictions on lease activities and operations. Onerous lease provisions will reduce industry participation in lease sales, and make the eventual operation under those leases uneconomic.</p>	<p>ADNR attempts to provide reasonable protection for the environment and cultural values of the lease sale areas while at the same time encouraging the economic development of state resources. Most mitigation measures include "feasible and prudent" language to allow for conditions that can only become known when the area is actually proposed for exploration and/or development. We urge interested parties to provide specific examples of onerous or overly restrictive measures so ADNR can evaluate the concerns raised when developing the measures.</p>

<p align="center">Alaska Oil and Gas Association, Judith M. Brady, 10/20/97</p>	
<p>Recommends that ADNR not decrease the area proposed for Sale 87. Previous sales in the Sale 87 area have resulted in multiple studies by ADNR, Fish and Game, DEC, as well as studies and comments by the North Slope Borough and other local entities. With this kind of information background, there should be little disagreement over the size of the area or the type of mitigation measures required for the lease sale.</p>	<p>ADNR has not reduced the aerial extent of Sale 87. Mitigation measures have been designed to provide protection for sensitive areas so that it would not be necessary to delete areas from the sale area.</p>
<p>Recommends that Sale 87 leases have a minimum seven-year primary term to allow a successful bidder to conduct exploratory drilling and seismic surveys during their limited winter season. Also recommends that Sale 87 leases have a twelve and one-half percent (12.5%) fixed royalty. This royalty rate has in the past encouraged exploration of more remote prospects by reducing the minimum economic reserve size required for each prospect to be developed.</p>	<p>Chapter Eight of this Finding contains an analysis of the leasing methods and terms. The selection of the bidding method, minimum bid, and term of the lease was made following the department's pre-sale analysis of economic, engineering, geological, and geophysical data. The bidding method selected was one that best secures revenues for the state without creating disincentives to industry.</p>

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<p>Recommends that the right to drill water wells in connection with leasing operations remain in the granting clause of the lease. We take strong exception with exclusion of “water wells” in the granting clause; historically, that right has always been included.</p>	<p>The right to drill water wells in the granting clause of the lease was removed after the state promulgated water rights regulations. Today, water withdrawals and water use permits on state lands are authorized by DMWM under 11 AAC 94. According to Division records, the granting clause has not been included in state oil and gas leases since 1971. Historically more of the state’s leasing experience has been without the clause, however the clause remains in pre-1971 leases including most Prudhoe Bay Unit leases.</p>
<p>Sale 87 is an onshore lease sale, yet there are several references to offshore operations and measures. All references to offshore operations should be eliminated.</p>	<p>The finding refers to offshore operations and potential impacts to offshore activities that might be anticipated as a result of onshore activities related to Sale 87.</p>
<p>Mitigation Measure 2 should clarify that the use of “existing gravel pads” is permissible. As written, it does not appear to allow the construction of exploration facilities (i.e., wells) on existing gravel pads, as has been general industry practice. The same clarification should be incorporated in Chapter 5, page 5-12, Mitigation Measure on Turbidity, and page 5-16, Mitigation Measure on Habitat loss minimization.</p>	<p>Mitigation Measure 2 deals with access to exploration sites, not the pads themselves. Mitigation Measure 6 specifically allows the use of existing gravel pads for exploration activities.</p>
<p>Mitigation Measure 4 places onerous restrictions on water intake pipes used to remove water from fishbearing water bodies. The goal is admirable, which is to keep the fish in the lakes and streams. However, fishbearing is a vague term that requires clarification or definition. Further, it is questionable whether an Operator can keep the maximum water velocity at the intake at 0.1 ft./second for non-permanent water withdrawals. This would equate to a velocity of 6 ft./min. in a vacuum truck hose, which is not what operators presently use for water withdrawal and may not be operationally achievable.</p>	<p>Currently, industry takes most of its water from designated and permitted water reservoirs (often flooded gravel mine sites) or from non-fishbearing lakes. ADF&G requires 1/4 inch mesh screens on the intakes in summer in sites that contain anadromous fish. They do not require intake screens in winter as (1) ice accumulation on the intake screens can restrict or prohibit water withdrawal, (2) the intakes are generally placed in the middle of the water column to avoid sucking up mud and gravel, and (3) fish generally remain near the bottom as they conserve energy and oxygen, and as a consequence also avoid the intakes. ADF&G is preparing a technical report (currently in the final review stages) describing development and testing of light-weight, readily deployable, portable water intake structures that have been developed in cooperation with the Alaska Department of Transportation and Public Facilities. Approach water velocities for the second generation 6 inch intake cylinders were less than ADF&G's most restrictive water intake criteria of 0.1 fps for whitefish fry.</p>
<p>Mitigation Measure 6 calls for exploration facilities to be constructed of ice, artificial gravel islands excepted. This clause does not allow use of abandoned gravel structures on a case-by-case basis so the ADNR should be receptive to allowing use of existing gravel that is not abandoned, as suggested above.</p>	<p>As stated in the response to Mitigation Measure 2, Measure 2 concerns access to exploration sites, not pads, and Mitigation Measure 6 does allow the use of existing gravel pads for exploration facilities.</p>

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<p>Mitigation Measure 7a should be modified. The terms “existing corridors” and “where conditions permit” in the measure are vague and require definition or criteria that operators can rely on. The burial of heated lines in North Slope permafrost is difficult from an engineering and operational perspective. Such an action can result in subsidence of the pipeline, thermokarsting of the ground, and other adverse conditions to the subsurface. It may be impracticable or impossible to technically bury heated pipelines as directed.</p>	<p>Existing corridors are presently defined by air routes between landing strips. Air space is controlled by the FAA and US Military. Previously, corridors were established by overland travel. Overland transportation generally runs east west along the Beaufort Sea coast and north south along rivers. Where “conditions” permit means “given existing permit approvals are acquired.”</p>
<p>Prohibiting the construction of causeways and docks in river mouths or deltas (Measures 10b and 10c) should be considered on a case-by-case basis. As presented, the prohibition predetermines that no feasible or prudent alternatives exist.</p>	<p>The state does not believe the construction of causeways and docks should be allowed in river mouths or deltas. The NSB also supports this prohibition. The intent of the measure is to ensure that approved causeways are designed, sited, and constructed to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics (e.g., salinity, temperature, suspended sediments) that result in exceedances of water quality criteria, and must maintain free passage of marine and anadromous fish. Therefore the suggested change will not be adopted.</p>
<p>Measure 14a is unclear and vague with respect to the definition of “unreasonable” conflicts. The measure allows for the imposition of unclear restrictions as deemed appropriate by the Director. Therefore, the “unreasonable” standard could change from one Director to another.</p>	<p>Unreasonable conflicts are instances where a proposed lease-related activity would violate policies of the NSB coastal management program (adopted verbatim into NSB Municipal Code) or miss the intent of this mitigation measure. Consider NSBCMP policy 2.4.3(d): Development shall not preclude reasonable subsistence user access to a subsistence resource. The intent of this policy is identical to that of Mitigation Measure 14; to ensure that development will not preclude reasonable subsistence user access to a subsistence resource. All lease activities must comply with local ordinance. NSB municipal code defines reasonable access as “access using means generally available to subsistence users.” Precluding access “addresses not only means of access, but access to areas where resources are present and can be used by subsistence users.” This standard is unlikely to change from Director to Director.</p>
<p>Considering Sale 87 is an onshore sale, we recommend Mitigation Measure 14b require AEWC consultation for offshore projects only.</p>	<p>Adopted. This measure evolved from a subsistence protection measure originally developed for a previous offshore lease sale (Sale 86). Measure 14 has been modified to fit the Sale 87 North Slope region. Because only onshore tracts will be offered, Measure 14b no longer requires consultation with AEWC, but still requires consultation with communities.</p>

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<p>In addition to documentation of resolutions and consultation with the affected communities, as prescribed in Mitigation Measure 14c, the appointment of a community representative who shall represent the community's interest is desirable. As may be the case, a community may not speak with one voice, but operators must rely on that voice to proceed with orderly consultations and resolution determination.</p>	<p>Measure 14 has been rewritten to reflect a consensus reached among state agencies and the NSB during a director-level elevation. The term requires lessees to consult with potentially affected subsistence communities and the NSB. DO&G does not see this as limiting the parties lessees can consult, nor does it require lessees to listen to only "one voice" in the community. On the other hand, appointment of a community representative may facilitate problem solving, improve communication between local residents and the lessee, and avoid confusion. Lessees are expected to be innovative in problem solving. For example, Arco Alaska Inc. assembled a subsistence advisory panel of community members to guide the design and planning of the Alpine project. In addition to municipal officials, elders, Village council members, and possibly Native corporations should be included in consultations.</p>
<p>Mitigation Measure 14d suffers from the use of vague language. It would be advisable to have criteria for what constitutes a concern and who specifically can raise such concern.</p>	<p>DO&G does not feel that such criteria are necessary at the lease sale phase to preserve the intent of this mitigation measure, that is to avoid unreasonable conflicts with subsistence harvesting. If problems arise, this measure provides the mechanism for conflict resolution. The language of this measure has been the subject of an ACMP consistency elevation, and represents the consensus reached between state resource agencies and the NSB.</p>
<p>Mitigation Measure 17b incorrectly states that the ADEC regulates annular disposal of muds and cuttings. The AOGCC now regulates annular disposal as well as other underground injection.</p>	<p>This is correct. As of September 1996, AOGCC now administers annular disposal of drilling waste under 20 AAC 25.080. The finding has been amended.</p>
<p>Regarding Lessee Advisory 4, applicable seismic survey operation measures should be treated as a separate consideration from leasing measures. Any such measures in the body of the lease are inappropriate. Lease measures adopted in Sale 87 have no effect on ongoing seismic operations. Additionally, if seismic surveys are conducted by or contracted for by the lessee after the sale they continue to be non-lease-related activities and need to be considered on an area-by-area basis focusing on the properties of the area.</p>	<p>It is true that one does not have to be a leaseholder to apply for and obtain geophysical exploration permits and Sale 87 measures may not be applied to existing permit application approvals. Lessees may or may not propose operations that include seismic surveys in the Sale 87 lease area, and may not therefore have any control over those activities. However, it is the state's position that post-lease seismic surveys conducted by or contracted by the lessee may be considered lease-related activities. Regardless, all seismic permits are tailored with site and time-specific stipulations to protect resource values; resolve use conflicts, and ensures consistency with coastal management program policies, local ordinance, and federal law.</p>

<p>BP Exploration (Alaska) Inc., E.P. Zselezky, 10/20/97</p>	
<p>Supports Sale 87 and new areawide leasing process. As with all lease sales, land availability and certainty of sale schedule are important considerations for planning, coordination of sale preparation with other exploration and leasing activities for budgeting purposes.</p>	<p>Comment noted. The areawide leasing program allows the state to more efficiently analyze and offer state lands for lease on a regular schedule, eliminates repeated, confusing requests for review to the public and helps Alaska compete for effectively in the world market for oil and gas exploration activity. Prior to each annual sale, ADNR will request new and significant information that has come available since the previous lease sale. Based on this information, ADNR may supplement the finding prior to holding the next annual sale. New information could result in the inclusion of additional mitigation measures or the removal of certain areas from leasing. Sale 87 is scheduled to be held in June 1998. The current leasing schedule calls for other North Slope areawide sales to be held each February in 1999, 2000, and 2001. Areawide sales in other areas of the state are scheduled in a similar regular manner.</p>
<p>While the best interest finding is comprehensive, the analyses could be improved with the following revisions: Since Sale 87 is an onshore area, discussion of offshore impacts should be confined to potential marine support activities related to onshore exploration and development.</p>	<p>While Sale 87 tracts are entirely onshore, offshore lease operations may be proposed for marine support or where petroleum accumulations straddle the coastline.</p>
<p>Greater recognition and discussion should be given to the oil industry's environmental planning activities and studies over the past 25 years on the North Slope and the Beaufort Sea. The extensive list of mitigation measures implies that such activities, including incorporation (voluntary) of environmental mitigation features in project design, are not standard practices when in fact they are.</p>	<p>The mitigation measures represent a consensus of state and local agencies and the public that has developed for the North Slope over the past 20 years. The Finding references numerous oil industry-sponsored studies and standard operating practices; however the mitigation measures are not the appropriate place to discuss the oil industry's environmental planning activities and studies. The agencies considered these projects in developing the measures. Listing the measures is intended to make it clear to the industry and the public what is expected of the industry, especially those companies who have not previously operated on the North Slope, during the time they use this area for oil and gas exploration and development. ADNR does not intend to imply that the industry is not already performing these actions and fully recognize that the industry often goes above and beyond these measures.</p>
<p>In light of the oil and gas industry regulatory programs described in Chapter One, there needs to be greater justification and rationale provided for the extensive mitigation measures proposed.</p>	<p>Measures adopted reflect consensus reached among state agencies and the NSB. The ACMP (6 AAC 50.120) requires ADNR to give "due deference" to state resource agencies having the knowledge regarding the resources for which they have management responsibilities. Rationale and justification is discussed during the ACMP consistency review process and is included in consistency determination documents.</p>

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<p>It should be noted that the requirement for Plans of Operations to comply with the requirements of coastal zone consistency regulations should only apply to portions of Sale 87 that are within the boundaries of the North Slope Borough coastal district.</p>	<p>It is correct that a review for consistency with coastal management program will not be conducted outside of the coastal zone. On the North Slope, the coastal zone includes all coastal areas inland to about 25 miles, and one-mile inland from the banks of major rivers. However, it is the position of the state that Sale 87 mitigation measures will apply to all portions of the Sale 87 area.</p>
<p>The language of Mitigation Measure 3a and 3b should be “tightened” with respect to ADF&G’s authority, the scope of which is defined in part according to the stream identification process that produces the atlas of anadromous fish streams.</p>	<p>While ADF&G does not require a permit for water withdrawal in lakes or streams with resident fish, it does require a permit for withdrawal from waters containing anadromous fish that have been designated by the commissioner and incorporated into the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes. Therefore inclusion of ADF&G in this measure ensures that its intent be preserved. The general practice of industry in recent years has been to try to identify and avoid fish-bearing lakes where possible for water withdrawal.</p>
<p>Regarding Mitigation Measure 6, there may be a complex chain of use and liability with respect to abandoned gravel structures. To encourage their use for exploration activities, where feasible, ADNR should address this problem and not impose final restoration requirements upon the penultimate user.</p>	<p>Comment noted. This is a growing problem for the state and potential lessees, especially if acquired facilities or parcels have contaminated soil or water in need of restoration. ADNR is currently reviewing the findings of a working group that was formed in 1991 (consisting of AOGA, DO&G, DL, ADF&G, and ADEC) to address this issue. The original effort was put on hold pending resolution of tax issues. Measures may be amended in subsequent annual sales if warranted by substantial new information.</p>
<p>That portion of Mitigation Measure 7a which requires pipeline burial “where soils and geophysical conditions permit” does not take into account the many technical and economic factors involved in selecting a pipeline design. This part of the measure should be deleted.</p>	<p>Technical considerations in addition to soil and geophysical conditions are addressed in the pipeline design phase prior to construction permit approval. Considerations include corrosion, leak detection, and spill response capability. The advantages of burial, such as invisibility and unrestricted movement of wildlife and people may be outweighed by disadvantages, such as reduced inspection and leak detection, spill response capability, scarring of the land, and effects of removal and rehabilitation of the corridor. Exceptions to this measure may be granted by the Director if an above ground pipeline is determined to be environmentally preferable. As noted above, these measures represent consensus among state resource agencies and the NSB regarding consistency with the ACMP. If problems and issues arise, these measures may be reviewed after the annual 60-day comment period for this Areawide sale and amended if necessary. Exceptions to this measure may be granted by the Director if an above ground pipeline is determined to be environmentally preferable.</p>

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<p>Mitigation Measure 10 presumes adverse environmental impacts from causeways. Sentences one and two of this measure should be deleted since the third sentence covers the environmental performance requirement. It is unclear why this measure is included with respect to an onshore sale. The document should confine itself to onshore activities and related marine support.</p>	<p>While Sale 87 tracts are entirely onshore, offshore lease operations may be proposed for marine support or where petroleum accumulations straddle the coastline. This measure represents consensus reached among state resource agencies and the NSB. ADNR considers language adopted since the most recent Arctic lease sale (Sale 86) an improvement over the total prohibition against causeways, which had been a standard measure since 1979.</p>
<p>Mitigation Measure 11 requires an evaluation that is already standard practice for North Slope operators. Such stipulations give the appearance that existing regulations or practices are inadequate.</p>	<p>ADNR has found it useful to repeat language that reflects standard practices as it helps to assure the public that the state will continue to do it right. Hopefully readers are not left with the impression that existing regulations are inadequate.</p>
<p>Regarding Mitigation Measure 14a, the “available options” identified may be infeasible, technically impracticable (e.g. subsea completion techniques) or make a project uneconomic. This stipulation should delete these options and simply require a performance standard.</p>	<p>This language is a result of inter-agency consensus. It was developed in lieu of seasonal and surface entry restrictions. Infeasible or impracticable alternatives are identified at the Plan of Operations permit phase.</p>
<p>While consultation is important (Measure 14b) for subsistence conflict resolution, there should be no formal requirement to consult with the AEWC unless there are offshore operations associated with Sale 87 exploration and development.</p>	<p>Agree. This measure, originally developed for a previous offshore lease sale (Sale 86), has been modified to fit the Sale 87 region. Because it is a totally onshore sale, Measure 14b no longer requires consultation with AEWC, but still requires consultation with potentially affected communities. Measure 14 has been rewritten to reflect a consensus reached among state agencies and the NSB during a director-level elevation.</p>
<p>Regarding Mitigation Measure 17b, AOGCC not ADEC regulates annular disposal of drilling wastes.</p>	<p>This is correct. As of September 1996, AOGCC now administers annular disposal of drilling waste under 20 AAC 25.080. The finding has been amended.</p>

Others

Northern Alaska Environmental Center, Sara Callaghan; Alaska Center for the Environment, Kevin Harun; Greenpeace, Melanie Duchin; Oilwatch Alaska, Jim Sykes, 10/20/97

Opposed to areawide sales and Sale 87. We do not believe the state cannot adequately assess the environmental impacts of leasing a 5.1 million-acre area with a single finding good for the next ten-years.

The state of Alaska has been gathering and analyzing data on the effects of oil and gas activities for more than 30 years. All areas to be offered in this sale have been offered and analyzed before and baseline information on the sale area collected by state entities including the University of Alaska have been incorporated into this best interest finding. Thus, this finding draws on three decades of North Slope lease sale research. See reference lists at the end of each chapter. In addition to data submitted by the public, other state agencies and federal agencies with professional expertise in all disciplines have contributed to the content of this document. The state recognizes that this document is a snapshot and a look forward; that change is constant; and that new information may prove or disprove statements of truth or fact. Where data is lacking, the document acknowledges deficiencies. For example, data on groundwater occurrence and yield is limited throughout Alaska. Issues of concern are continuously researched.

This document will be amended when new information is obtained. An annual 60-day comment period allows for continued public and agency input on annual leasing decisions. If substantial new information is obtained which may affect the current document, a supplement to the finding will be issued, and if necessary, additional resource protection measures may be imposed.

The preliminary finding and ACMP analysis fail to adequately discuss past and current impacts of oil and gas activities on habitat loss and degradation; air and water pollution; oil spills; wilderness recreation; and effects on subsistence resources. The preliminary finding and ACMP analysis fail to adequately discuss the potential direct and indirect harm and cumulative effects in the future from exploration and development of Sale 87 leases. The state has not provided mitigation measures that will adequately protect the environment, wildlife, and subsistence uses.

Sale 87 includes mitigation measures designed specifically to protect resource values at subsequent phases when permit authorizations are made. AS 38.05 requires that the division discuss the cumulative effects of Sale 87 and subsequent oil and gas activities on habitats, fish and wildlife populations and human use of the sale area. Chapter Five discusses the reasonably foreseeable cumulative effects of Sale 87, including effects on air and water quality and habitats. ADNR disagrees that this discussion is inadequate. As a balancing agency, Title 38 of Alaska law makes ADNR responsible for allowing economic development while providing maximum practicable protection to fish and wildlife resources. Sale 87 mitigation measures have been developed with this goal in mind. State resource agencies and the NSB have determined that Sale 87 is consistent with the ACMP and the NSBCMP.

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<p>The state should analyze the potential contribution of greenhouse gas emissions from the anticipated oil development, processing, transportation, and consumption of crude oil and its products, as well as the development of climate-friendly alternatives such as wind and solar power.</p>	<p>Assessing the effects of future hypothetical emission volumes would be speculative, as both the quantity and quality of future emissions are not reasonably foreseeable. Incorporating speculation into the document would cloud the director's determination as to whether this lease sale is in the best interests of the state. However, because of the state's interest in encouraging clean air, a new lessee advisory has been added to the document. Lessee Advisory 12 encourages lessees to adopt conservation measures to reduce hydrocarbon emissions. Additionally, the state recognizes that in the long run, sources of energy other than oil and gas will be needed. Lessee participation in conducting research on alternative energy sources is appreciated.</p>
<p>In order to protect fish and wildlife resources, subsistence resources, and scenic and wilderness resources, we urge ADNR to delete from the areawide leasing program all areas within 5-miles of the Canning and Colville Rivers.</p>	<p>DO&G does not believe deletions are necessary considering the numerous mitigation measures and lessee advisories for Sale 87, and the numerous state, federal and local laws and policies governing oil and gas development. These measures and laws strongly favor environmental protection at some hidden cost to the private sector. Additionally, any activities that might result from the Sale will go through another public review under the ACMP. There will be an opportunity to add further mitigation measures at that time.</p>

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<p>The mitigation measures (9 and 21) proposed by the state to protect these areas are not adequate, because they include “to the extent feasible and prudent” language. This is a huge loophole largely subject to the interpretation of the oil companies. The words, “when feasible and prudent” should be removed from all lease sale mitigation measures.</p>	<p>DO&G is currently reviewing the effectiveness and efficacy of mitigation measures as they are presently worded. DO&G’s use of “feasible and prudent” in its mitigation measures does not constitute a loophole. 6 AAC 80.130(d) specifically allows for a “feasible and prudent” standard of review when granting approvals for activities such as oil and gas development. Uses and activities in coastal areas that do not conform to the habitats standards may be allowed by districts or state agencies if there is a significant public need for the activity, there is no feasible or prudent alternative to meet the public need for the proposed use or activity, and all feasible and prudent steps will be taken to maximize conformance with the habitats standards.</p> <p>“Feasible and prudent” is defined by 6 AAC 80.900 to mean “consistent with sound engineering practice and not causing environmental, social or economic problems that outweigh the public benefit to be derived from compliance with the standard modified by the term ‘feasible and prudent.’” The FEIS for the ACMP states that the Alaska Coastal Policy Council adopted the limitations of 6 AAC 80.130(d) in recognition of the fact that complete nondegradation is an impossible standard to meet, and that in certain instances, tradeoffs between natural values and other human values would have to be made. The FEIS further states that the term “feasible and prudent” is used to describe situations when a normally applicable standard may be departed from; where forcing compliance with the standard would be impossible or cause a worse result than non-compliance. The term appears in the ACMP in the standards on coastal development, energy facilities, transportation and utilities, mining and mineral processing, and habitat protection. This term is not subject to the interpretation of the lessee. Lessees do not administer the ACMP.</p>
<p>Lessee Advisories should be made binding lease conditions and strengthened to eliminate loopholes.</p>	<p>Lessee Advisories contain information to lessees on existing law or important operational information about oil and gas industry activities in the sale area. Lessee advisories may contain information that is subject to change, whereas mitigation measures generally do not. The preface to the mitigation measures clearly states that lease-related activities must comply with all relevant local, state, and federal laws, including the policies of the ACMP and local district plans. Therefore, in that they reflect existing law, some lessee advisories are binding lease conditions. Others may contain information on regulatory authority beyond ADNR jurisdiction.</p>
<p>It is unclear whether the state intends the Staines River part of the Canning to be covered by its terms which mention the Canning River.</p>	<p>It is the state’s intent that the Staines River portion of the Canning River be covered by measures that mention the Canning River.</p>

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<p>Recommend adding a new lease stipulation that no exploration or development activities, including groundwater withdrawal, impoundment, or diversion of water from rivers, streams, lakes, wetlands or groundwater in the Canning/Staines River, areas that form the border of the Arctic National Wildlife Refuge, or from within the Arctic Refuge shall be allowed.</p>	<p>This is not necessary at the lease sale phase to protect natural resources at subsequent phases. Impoundment and diversion of waterbodies are subject to the requirements of the Clean Water Act under permits authorized by EPA, ADEC, COE, and if it could affect anadromous fish passage, ADFG. The Division of Mining and Water Management manages groundwater and surface water withdrawals. During the multi-agency permitting process, stipulations are attached to any number of permits as appropriate for the specific project.</p>
<p>The state's analysis does not adequately describe the past, existing, and future environmental impacts to fish and wildlife habitats, air and water quality, wilderness values, subsistence resources and access, and the cumulative effects of onshore and offshore development including the effects of climate change.</p>	<p>AS 38.05.035 limits the scope of the best interest finding. The topics that must be considered in a best interest finding are fish and wildlife species and their habitats in the area; the current and projected uses in the area, including uses and value of fish and wildlife; the reasonably foreseeable cumulative effects of oil and gas exploration, development, production, and transportation on the sale area, including effects on subsistence uses, fish and wildlife habitat and populations and their uses, and historic and cultural resources; lease stipulations and mitigation measures, including any measures to prevent and mitigate releases of oil and hazardous substances, to be included in the leases, and a discussion of the protections offered by these measures. These topics and a history of past development and its documented effects are discussed in the finding.</p> <p>While the document does discuss the effects of existing and potential oil and gas activities, it does not describe the effects of past industry practices because methods have changed. For example, waste disposal sites were previously unlined pits, which resulted in groundwater contamination. It would not be reasonable to assume that the similar contamination effects would occur as a result of leasing, because current waste disposal practices do not have the same effect on the environment.</p> <p>Granting a lease alone does not authorize any activities beyond what is already permitted. It does not authorize any activity that would impact air and water quality or violate federal law, like the Clean Water Act. Permits issued by federal, state and local agencies regulate specific activities that might occur if the exploration, development and production phases ultimately come to fruition. Lessees are required to comply with the mitigation measures developed at the lease sale phase, and additional project-specific measures can be imposed as needed to be consistent with the ACMP and the NSCMP.</p>

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<p>The state does not adequately predict the consequences of lease sales and their resulting environmental impact; therefore it cannot justify one best interest finding to be good for the next ten years.</p>	<p>See Chapter One for a list of required ingredients for a best interest finding; a best interest finding is different than an EIS required under the National Environmental Protection Act. This document adequately assesses the reasonably foreseeable cumulative effects of leasing. As noted above, this finding draws on three decades of lease sale area research. The finding will be amended when new information is obtained. An annual 60-day comment period allows for continued public and agency input and comment. If substantial new information is obtained which may affect the current document, a supplement to the finding will be issued, and if necessary, additional resource protection measures may be imposed.</p>
<p>The state fails to predict how many oilfields will come on line during this period, or to estimate how many new oil fields would be discovered and delineated, and to project the number of drill sites, processing plants, and docks, road miles, pipeline miles, miles of seismic lines, acres of gravel fill and excavation, and quantities of air and water pollutants resulting from the sale.</p>	<p>The location and sizes of any new discoveries, or even their existence is unknown at the time of the sale, and there is no reasonably accurate means to estimate their presence. Hence, it is also not possible to accurately predict the location, size, or type of infrastructure that might be eventually necessary. Speculation concerning future development activities that will be subject to independent permitting requirements is not prudent at the time a decision is made to lease. State law specifies that the director may not be required to speculate about possible future effects subject to future permitting that cannot reasonably be determined until the project or proposed use is more specifically defined. This includes speculation about the exact location and size of facilities, the economic feasibility of ultimate development, and future environmental or other laws that may apply at the time of any future development (AS 38.05.035(h)).</p>
<p>The state fails to assess the likelihood of development proposals continuing to be made for extremely sensitive habitats, such as within the floodplain of the Colville River, or to estimate how often oil companies would say it is not "feasible and prudent" to follow the terms of mitigation stipulations.</p>	<p>Again, assessing the likelihood of development in specific areas and estimating the type of activities that might eventually be necessary is extremely speculative. Incorporating speculation into the document would cloud the director's determination as to whether this lease sale is in the best interests of the state.</p>

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<p>Although recent advances in operations have reduced the environmental footprint of development, the geographic spread of new development is expected to be considerably more extensive than what has occurred to date. New fields under development may require more intensive infrastructure because of the different depths of the reservoirs or the types of oil being extracted. This necessitates an on-going assessment of impacts that will not occur with the Areawide sale approach.</p>	<p>ADNR does not expect the geographic spread of new development to be more extensive than what has occurred to date in existing oilfields. Regarding footprints, new field developments require fewer drilling sites than in the past. Chapter Two includes a discussion of methods of oil and gas extraction. Expansive facility additions would not be needed to develop fields adjacent to existing infrastructure and other accumulations beneath the existing oilfields. Extraction of new accumulations beneath the existing oilfields would be accomplished with existing roads, facilities, and drill sites. This document will be amended when new information is obtained. An annual 60-day comment period allows for continued public and agency input on annual leasing decisions. If substantial new information is obtained which may affect the current document, a supplement to the finding will be issued, and if necessary, additional resource protection measures may be imposed. Information on any impacts of geographic spread would be considered under this review.</p>
<p>The finding needs to describe the geographic extent and location of privately owned areas that will be jointly leased under this areawide sale. Although the model lease sale form was included in the Appendices, it is not clear what areas would be covered by it, and how the leasing conditions would apply. How do the state's laws and standards of environmental protection apply in these areas? Do they apply to the bed and banks of the Colville River where ASRC has ownership?</p>	<p>Jointly owned state/ASRC lands in the proposed sale area are identified on tract maps. Because there is no solution to the surface use agreement conflict (described in Chapter Two), acreage under these areas may not be available for leasing. This affects five tracts totaling 5,044 acres (Tracts 917, 918, 924, 923, and 926). Acreage not owned by the state, already subject to an oil and gas lease, or clouded by title claims will be excluded from the tract area and only those lands free and unencumbered will be included in Sale 87. Any activity on a Sale 87 lease, or accessing a Sale 87 lease, regardless of surface ownership, is subject to Sale 87 mitigation measures.</p>

<p>Mitigation measures should be applicable to geophysical exploration activities including water withdrawals, surface damage to the tundra including riparian willows, degradation of overwintering fish habitat, and disturbance to denning polar bears.</p>	<p>All Sale 87 mitigation measures will apply to lease-related activities regardless of surface ownership status. Geophysical exploration is regulated as a separate activity from leasing, however some exploration activity may be considered lease-related and mitigation measures may apply. Standard permit conditions to protect resource values are included in the ACMP general concurrence (GC) list. This list includes common activities that have been determined to be consistent with the ACMP. Provisions in the list provide for protection of the tundra surface, riparian willows, and fish habitat. For example, standard permit conditions in GC-25 stipulate that movement of equipment through willow (<i>Salix</i>) stands must be avoided wherever possible. It also stipulates that equipment, other than vessels, must not enter open water areas of a watercourse during winter. Ice or snow bridges and approach ramps constructed at river, slough, or stream crossings must be substantially free of extraneous material (i.e., soil, rock, wood, or vegetation) and must be removed or breached before spring breakup, and alterations of the banks of a watercourse are prohibited. ADF&G's fish habitat permit would be required if the exploration program encountered anadromous fishbearing streams. Standard fish permit requirements are presented in Sale 87 mitigation measure 16. Water withdrawals and water use permits on state lands are authorized by DMWM under 11 AAC 94. Any violations should be reported to DO&G immediately.</p> <p>GC-25 stipulates that operations must avoid occupied grizzly bear dens by one-half mile unless alternative mitigative measures to minimize disturbance are authorized by ADNR after consultation with ADFG. Known den locations shall be obtained from the ADFG Division of Wildlife Conservation prior to starting operations. Occupied dens encountered in the field must be reported to the above, and subsequently avoided.</p> <p>GC-25 also advises applicants that the Marine Mammal Protection Act prohibits intentional disturbance, harassment, catching or killing of marine mammals. Operations must avoid known polar bear dens by one mile. Known den locations shall be obtained from the U.S. Fish and Wildlife Service prior to starting operations. New dens encountered in the field must be reported to the above, and subsequently avoided by one mile.</p>
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	<p>U.S. citizens may be authorized by the NMFS to take small numbers of marine mammals from a non-depleted stock incidentally, but not intentionally, in specified areas. To comply with federal regulations, oil and gas activities in important polar bear habitat areas are subject to a Letter of Authorization (LOA) from the USF&WS Regional Director of the Alaska Region. ADNDR recommends that this authorization be obtained by the permittee before conducting any operations in or near coastal areas. The decision to request a LOA is up to the individual operator, although they are liable for incidental takes in the absence of a LOA. LOA's specify terms and conditions appropriate for the conservation of polar bears, such as interaction plans and detection efforts. LOA's are tailored to the individual project and take into consideration factors including the time period and specific location where the activity is to take place.</p>
<p>Mitigation Measures should be part of the actual lease. Mitigation measures should be included in plans of operation, exploration or development and other permits.</p>	<p>Mitigation measures are attached to the lease and are considered part of the lease contract. Failure to adhere to the mitigation measures could result in loss of the lease.</p>
<p>An important lease term that was in previous lease sales has been deleted and should be reinstated. Recommends adopting the following: "Upon abandonment of drilling sites, all buildings, erosion armament, production platforms, pipelines, roads, and other facilities must be removed and the site rehabilitated."</p>	<p>Abandonment, ownership, and liability issues are complex and will require greater attention in the future as existing oil and gas resources are depleted and the surface infrastructure ages. ADNDR is currently reviewing work completed by a group that was formed in 1991 (consisting of AOGA, DO&G, DL, ADF&G, and ADEC) to address this issue. The original effort was put on hold pending resolution of tax issues. Numerous measures are currently under review, including abandonment provisions.</p>
<p>Construction of artificial gravel islands or gravel drilling pads or airstrips for exploration should not be allowed, as this is not state-of-the-art technology. Recommends modifying mitigation measure 6 to read, "Exploration facilities shall be temporary and must be constructed of ice. Re-use of onshore abandoned gravel structures may be permitted on a case-by-case basis by the Director, after consultation with the director, DL, and ADF&G."</p>	<p>Current industry practice is that exploration is only conducted in winter with the use of ice roads and ice pads. It is highly unlikely that an artificial gravel island, gravel road, or airstrip would be constructed for exploration of Sale 87 tracts, because of the lower cost alternative. These measures represent consensus among state resource agencies and the NSB. If problems and issues arise, these measures may be reviewed after the annual 60-day comment period for this areawide sale and amended if necessary.</p>

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<p>Regarding measure 7a, there is no evidence that soil and geophysical conditions permit that pipelines be safely buried within the Sale 87 area. Extensive sections of the Trans-Alaskan Pipeline needing repair due to corrosion have been where it was buried in river floodplains on the North Slope. Concerned about the effects of oil spills from pipelines buried beneath rivers. The technology of this technique (burial) has not been adequately proven to be safe or preferable to other alternatives. The third sentence of measure 7a stating a preference for buried pipelines should be deleted.</p>	<p>Technical considerations in addition to soil and geophysical conditions are addressed in the pipeline design phase prior to construction permit approval. Considerations include corrosion, leak detection, and spill response capability. The advantages of burial, such as invisibility and unrestricted movement of wildlife and people may be outweighed by disadvantages, such as reduced inspection and leak detection, spill response capability, scarring of the land, and effects of removal and rehabilitation of the corridor. As noted above, these measures represent consensus among state resource agencies and the NSB regarding consistency with the ACMP. If problems and issues arise, these measures may be reviewed after the annual 60-day comment period for this areawide sale and amended if necessary.</p> <p>The intent of mitigation measure 7a is to minimize the environmental impact that could result from pipelines. Pipeline technology on the North Slope is advancing. New corrosion-fighting techniques have been developed that reduce the risk of leaks. Any new development that might occur as a result of Sale 87 will be able to take advantage of the lessons learned from previous attempts. Burying pipelines on the North Slope is possible in some cases; however, the final decision to bury or not can only be made when all of the details about the new project are known.</p>
<p>Permafrost and erosion should be added to the pipeline hazards listed in measure 7b.</p>	<p>Measure 7(b) requires that all pipelines be designed and constructed to provide adequate protection from subfreezing temperatures and other hazards. Hazards by definition under 6 AAC 80.900(9) include erosion. Therefore, the suggested change is not necessary.</p>

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<p>The restriction on gravel mine sites in measure 9 only applies to exploration, and is thus weak. Please modify the third sentence of the measure to read, "Gravel mine sites shall not be located within floodplains of rivers and streams." Add a new sentence to measure 9 to include restrictions previously included in lease terms (see Term 20 for state Sale 80, Shaviovik): "Gravel extraction shall be prohibited from barrier islands, spits, tidelands, submerged lands, offshore shoals, lagoons and nearshore areas." Despite the NSB policy regarding mining of beaches, it is in the public interest to make this a clear lease stipulation.</p>	<p>While it may be consistent with the intent of this mitigation measure, the cost of prohibiting gravel mine sites on the North Slope from being sited in floodplains may outweigh the benefits to resource protection. See Lessee Advisory 1. Sale 80 Term 20 is enforced through NSBCMP policies 2.4.5.1 and 2.4.5.2 and NSB Code §19.70.050(J) & (R). Substantial alteration of shoreline dynamics is prohibited. NSBCMP policies and municipal code will only permit mining and gravel extraction in the coastal area when a lessee can establish (1) there is a significant public need; (2) they have rigorously explored and objectively evaluated all feasible and prudent alternatives; and (3) no feasible and prudent alternative exists. They additionally require evaluation of such proposals with respect to type of extraction operation, location, possible mitigation measures, and season so as to lessen, to the maximum extent practicable, environmental degradation of coastal lands and waters. Further, gravel mine permits are approved by the DL and may not be lease-related activities. Therefore DO&G will not adopt the suggested addition.</p>
<p>Strengthen measure 10a to read, "Solid fill causeways offshore in the Beaufort Sea, including in lagoons, river mouths, or deltas should not be allowed." Strengthen measure 10b to read, "Causeways and docks shall not be located in river mouths or deltas. Artificial gravel islands and bottom founded structures shall not be located in river mouths or active stream channels on river deltas."</p>	<p>It is not clear that adoption of this additional language is necessary to ensure that the intent of the measure is achieved. The intent of the measure is to ensure that approved causeways are designed, sited, and constructed to prevent significant changes to nearshore oceanographic circulation patterns and water quality characteristics (e.g., salinity, temperature, suspended sediments) that result in exceedances of water quality criteria, and must maintain free passage of marine and anadromous fish. This standard will be applied to all nearshore gravel structures regardless of location. Although not the preferred alternative, location of certain facilities in river mouths or active stream channels may sometimes be necessary for oil field development.</p> <p>The language contained in this measure has evolved through extensive discussion among state resource agencies and the NSB, and represents consensus reached among state resource agencies and the NSB that Sale 87 is consistent with the ACMP and NSB Coastal district policies. This measure may be amended through inter-agency consensus if substantial new information warrants modification. Therefore, DO&G cannot adopt the recommended change.</p>

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<p>In order to assure that adequate subsistence resources and harvest opportunities are maintained, and to evaluate the nature and extent of conflicts with subsistence that arise, measure 14c should be modified by adding a new sentence to the end of the term which would read, "Any agreements, including conflict avoidance agreements, which result from the consultations required by the lease term, shall be included in the plan of operations."</p>	<p>Mitigation measure 14 has been strengthened to require plan of operations to include a discussion of the reasonably foreseeable effect on subsistence activities of any other operations in the area that applicants or affected communities know will occur during the lessee's proposed operations. Also required in the plan of operations is a discussion of resolutions reached or not reached during the consultation process and plans for continued consultation. The lessee shall identify who participated in the consultation and send copies of the plan to participating communities and the NSB when it is submitted to the division.</p>
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State-of-the-art technology no longer requires the use of reserve pits on the North Slope and therefore the state should not allow their construction. Replace sentences 4 through 6 of measure 17b with the following: "Surface discharge of drilling muds and cuttings into lakes, streams, rivers, wetlands, lagoons, and Beaufort Sea waters is prohibited. Use of reserve pits for exploratory, production, or development well drilling waste disposal is prohibited because other alternatives exist."

AOGCC regulations require that prior to drilling a well, a proper and appropriate reserve pit 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 groundwater and damage to the surface environment (20 AAC 25.047). Thus the statement that reserve pits are no longer required is false.

The state discourages the use of reserve pits for permanent disposal of drilling waste and prefers reinjection of drilling fluids into the substrate. This is discussed in Chapter Five. However, there may be instances where injection is not the environmentally preferred option or state-of-the-art waste disposal technology. Solid waste disposal regulations, including provisions for temporary storage of drilling waste have been adopted by ADEC under 18 AAC 60. These regulations require operators of waste disposal facilities that accept drilling waste to include methods used to prevent discharge of drilling waste leachate and certification that the waste will be removed from the property within one year after completing the drilling operation. Containment structures must be leak-proof and lined with a material compatible with hydrocarbons and drilling waste. Monitoring requirements include site inspections and surface water or active thaw zone monitoring. Facilities must comply with several technical guidelines, including EPA's *Solid Waste Disposal Facility Criteria Technical Manual* (1993). 18 AAC 60.430 stipulates that "if the department finds that a drilling waste disposal facility is unstable or poses a risk to public health or safety or the environment, the department [ADEC] will require the owner to conduct a 5-year monitoring program. Regulations have also been adopted for closure of inactive reserve pits (18 AAC 60.440).

Measures and lessee advisories in place for this sale represent consensus reached among state resource agencies (ADNR, ADF&G, ADEC) and the North Slope Borough during the ACMP consistency determination process. As part of areawide leasing, DO&G will hold an annual 60-day comment period allowing for continued public and agency input on sale mitigation measures. If substantial new information is obtained which may affect the current document, a supplement to the finding will be issued, and if needed, additional resource protection measures may be imposed.

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<p>Strengthen measure 18a to read, "Disposal of wastewater into freshwater bodies, including Class III, IV, VI, and VIII wetlands, riparian wetlands, fish-bearing streams and lakes, lagoons, and river deltas is prohibited." Revise measure 18b to reflect the current state-of-the-art regarding these toxic fluids to read: "Surface discharge of reserve pit fluids shall be prohibited." Revise measure 18c to read, "Disposal of produced waters in upland areas shall be by subsurface disposal techniques." Revise measure 18d to read, "Discharge of produced waters into open or ice-covered marine waters, including lagoons and river deltas, is prohibited."</p>	<p>Discharge of wastewater and other fluids are authorized under the National Pollution Discharge Elimination System Arctic general permit. This program is administered by EPA and permits require ADEC certification. ADNR and ADEC recognize that there may be circumstances where surface discharge is acceptable, such as during training or spill response exercises. AOGCC and ADEC, not ADNR regulate disposal by injection. While the state prefers injection, there may be circumstances where an alternative disposal method is preferable. These measures as written give the state flexibility to consider alternative methods. ADNR may in its discretion require additional measures at the time it reviews lease plans of exploration, operation, or development.</p>
<p>Revise measure 19 to read, "All facilities, including gravel mines, shall be sited outside identified brant, white-fronted goose, snow goose, tundra swan, king eider, common eider, spectacled eider, Steller's eider, and yellow-billed loon nesting, molting, and brood-rearing areas. Baseline monitoring studies for the purpose of identifying these habitats shall be based on at least five years of data approved by the U.S. Fish & Wildlife Service."</p>	<p>Spectacled and Steller's eiders have been added to the list of bird species in measure 19. This term originally applied only to brant, snow geese and common eider. At the request of other agencies, the species list has been expanded over the years including the addition for Sale 87 of spectacled and Steller's eiders. Depending on how one defines nesting and brood-rearing areas for each particular species, this ever-expanding list could close large areas to facility siting because of overlapping use areas for the various species. Permanent staffed facilities are most likely to be larger (greater actual habitat loss) and have more activity associated with them (greater functional habitat loss) than would unstaffed or remote facilities (with the possible exception of roads with traffic). For some of the more concentrated use areas (brant nesting colonies or snow geese on Howe Island) the state expects industry to avoid these areas of their own volition.</p>

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Regarding measure 20 and the increasing industrial encroachment of brown bear and polar bear habitat, most polar bear and brown bear dens will not be identified prior to drilling and development due to inadequate funding of such monitoring studies and the inherent limitations (only some dens are ever located). Therefore, measure 20 will have no effect for those dens. Recommend that operations should not be approved for areas where dens have been located in the past, as these vicinities would likely be used in the future, in addition to documented dens. Revise measures 20a and 20b to include all past or present den locations. Measure 20c should be revised to state, "lessees, including operators of geophysical studies, shall be required to prepare and implement grizzly bear and polar bear interaction plans."

According to ADF&G, as bears dig new dens each year, the locations of past dens will not accurately predict the location of the current years' dens. Locations of past years' dens will provide a general indication of the types of areas that are selected for dens and would provide information that the general area should be examined closely for den sites in the current year.

Most polar bear dens are identified prior to drilling and development. All known den locations from the previous season are obtained from USFWS. Land survey crews look for dens prior to ice road route selection and some terrain, such as coastal bluffs where denning is common are avoided. Dens are identified prior to seismic and drilling. Currently, there is some ongoing research on the North Slope on polar and grizzly bears, that through the use of radio and satellite collars, allows identification of the denning sites of some bears. However, as all bears are not collared, not all bear den sites are currently known. Some research is focusing on the use of forward-looking infrared thermal imaging system (FLIR) to identify bears in dens, which if it becomes operational for this task, could be used to scan routes of ice roads, seismic lines, etc prior to operation.

Standard permit conditions to protect resource values are included in the ACMP general concurrence (GC) list. This list includes common activities that have been determined to be consistent with the ACMP. GC-25 advises applicants that the Marine Mammal Protection Act prohibits intentional disturbance, harassment, catching or killing of marine mammals. GC-25 stipulates that Operations must avoid occupied grizzly bear dens by one-half mile unless alternative mitigative measures to minimize disturbance are authorized by ADNR after consultation with ADFG. Known den locations shall be obtained from the ADFG Division of Wildlife Conservation prior to starting operations. Occupied dens encountered in the field must be reported to the above, and subsequently avoided. Additionally, Operations must avoid known polar bear dens by one mile. As noted in Chapter Three, female polar bears show fidelity to denning locations of the same substrate (onshore, offshore), not exact location. Nonetheless, known den locations shall be obtained from the U.S. Fish and Wildlife Service prior to starting operations. New dens encountered in the field must be reported to the above, and subsequently avoided by one mile.

	<p>U.S. citizens may be authorized by the NMFS to take small numbers of marine mammals from a non-depleted stock incidentally, but not intentionally, in specified areas. To comply with federal regulations, oil and gas activities in important polar bear habitat areas are subject to a Letter of Authorization (LOA) from the USF&WS Regional Director of the Alaska Region. ADNDR recommends that this authorization be obtained by the permittee before conducting any operations in or near coastal areas. The decision to request a LOA is up to the individual operator, although they are liable for incidental takes in the absence of a LOA. LOA's specify terms and conditions appropriate for the conservation of polar bears, such as interaction plans and detection efforts. LOA's are tailored to the individual project and take into consideration factors including the time period and specific location where the activity is to take place.</p> <p>In the interests of health and safety, it is prudent to prepare and implement bear interaction plans for operations proposed to take place in bear habitat. The subject of <u>requiring</u> bear interaction plans was decided at an elevation of the issue for Sale 80 between DO&G and ADF&G. It is not logical to require lessees to prepare and implement grizzly bear interaction plans prior to project proposal. If a project is proposed that includes activities in close proximity to areas frequented by bears, DO&G encourages the lessee through Measure 20, to prepare and implement interaction plans.</p>
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<p>Revise measure 21 to read, "Riparian buffers. Onshore facilities (including drill pads, processing plants, gravel mines, airstrips, waste-disposal sites, storage pads, water removal structures, docks, and others) except for road crossings or pipeline crossings aligned perpendicular to watercourses, shall not be sited within 500 feet of fishbearing streams. Additionally, facilities shall not be sited within one-half mile of the banks of the main channel of the Sagavanirktok, Kavik, Shaviovik, Kadleroshilik, Echooka, Ivashak, Kuparuk, Toolik, Anaktuvuk, and Chandlar Rivers. Finally, to provide maximum protection, onshore facilities as listed above shall not be located within five miles of the banks of the main channel of the Colville River nor shall onshore facilities, including roads or pipelines, be located within 5-miles of the Arctic National Wildlife Refuge boundary along the Canning/Staines River."</p>	<p>Part of this proposed change to Measure 21 pertains to lease-related activity (drill pads, processing plants). However, gravel mines, waste disposal facilities, airstrips and docks may not be lease-related either before or after field development and production. Siting of such facilities is subject to local authority. It is not in the state's best interest to preclude local authority over facility siting.</p> <p>Measure 21 as written provides the protection recommended, with the exception that essential facility siting will be allowed in buffers if the director, after consulting with DF&G, determines that facility restrictions within the buffers are not feasible or prudent. The feasible and prudent standard is allowed by the ACMP in situations when a normally applicable standard may be departed from; where forcing compliance with the standard would be impossible or cause a worse result than non-compliance. Five-mile buffers along the Colville and Canning Rivers are not necessary given the mitigation measures and lessee advisories for the sale, along with the considerable body of laws and regulations governing all facets of oil and gas development. Five-mile buffers would essentially preclude exploration and development on the affected tracts even though permit stipulations could achieve the intent of this measure: to protect riparian habitat.</p>
<p>Concerned about the potential effects of seismic operations to tundra vegetation, polar bears, ringed seals, and other marine mammals, chronic oil and hazardous spills, and wastes littering the tundra. Revise the third paragraph of Lessee Advisory 4 to read: "Copies of the non-proprietary portions of all Geophysical Exploration permit applications shall be made available to the NSB, AEWC, potentially affected subsistence communities and the public for comment and later analysis of the cumulative effects of such programs (including geographic extent, timing, nature (3-D or 2-D), and line miles surveyed)."</p>	<p>Seismic operations are authorized by a land use permit that is subject to the ACMP review process. DO&G notifies the other resource agencies and the NSB when a permit application is received. The NSB should be contacted regarding their notification list.</p>
<p>Revise Lessee advisory 5c to state: "To minimize impacts on Dolly Varden (arctic char) and other anadromous fish overwintering areas, all temporary or permanent facilities shall be sited one-half mile outside identified and probable Dolly Varden (arctic char) and other overwintering fish areas."</p>	<p>To protect Dolly Varden overwintering and spawning habitat, measure 21 has been modified by adding a new paragraph: No facilities will be sited within one-half mile of identified Dolly Varden both overwintering/spawning areas on the Kavik, Canning and Shaviovik Rivers. Road and pipeline crossings will not be sited within these buffers unless the Director, after consulting ADF&G, determines that such facility restrictions are not feasible or prudent.</p>

Appendix A: Comments and Responses

<p>Dolly Varden overwintering areas should be deleted from the sale area.</p>	<p>See comment above regarding measure 21. Given the numerous mitigation measures in place, DO&G does not believe deletions are necessary at the lease sale phase to protect Dolly Varden at subsequent phases.</p>
<p>Revise Lessee advisory 8b to read: "Buffer zones of not less than 500 feet shall be required to separate onshore oil storage facilities and sewage ponds from freshwater supplies, streams, lakes, and key wetlands, except in cases where greater buffer zones were required in Measure 21. Reserve pits shall not be allowed."</p>	<p>The intent of this measure is to advise lessees of ADEC's laws and regulations governing oil storage facilities. It is not within DO&G's authority to change ADEC's laws and regulations, which were developed after public review, in a mitigation measure.</p>
<p>The list of sensitive areas identified in Lessee advisory 9 should be revised to read: "a. The Canning/Staines River Delta and Rivers, January-December; b. The Colville River Delta and River, January-December; c. The Sagavanirktok River delta, January-December."</p>	<p>Lessee Advisory 9 lists certain areas that are <u>especially</u> valuable for their concentrations of marine birds, marine mammals, fishes or other biological resources; cultural resources; and for their importance to subsistence harvest activities. The resource agencies have identified the major river deltas as being especially valuable and needing special consideration during the development of plans of operations for activities that may occur in those areas. The Colville, Canning and Staines Rivers all receive due consideration and have mitigation measures to protect them. For purposes of applying mitigation measures the state considers the Staines River a dis-tributary and part of the Canning River.</p>

Alaska Eskimo Whaling Commission, Maggie Ahmaogak, 12/4/97	
<p>The AEWK has a concern related to the severe impacts resulting from pollution, particularly an oil spill, in light of the lack of response and cleanup capability in the Arctic. If an oil spill occurs and goes out to the ocean, it will flow directly out to the migration corridor of the bowhead whales.</p>	<p>Regarding oil spill concerns, the likelihood of a large onshore oil spill flowing into the ocean and impacting bowhead whales is very small and has never occurred in over thirty years of North Slope exploration and development. However, the possibility, though very unlikely, does exist and must be addressed. Oil spill response and cleanup in the Arctic is difficult and complicated by the harsh conditions found there. That is precisely why the industry puts so much effort and money into preventing spills. A number of mitigation measures have been adopted to minimize the potential for a large oil spill from a well blowout or pipeline rupture from reaching the Beaufort Sea. Proposed Mitigation Measure 7a requires that pipelines be located so as to facilitate the containment and cleanup of spilled hydrocarbons. Proposed Lessee Advisory 8 requires impermeable lining and diking, or equivalent measures such as double walled-tanks for onshore oil storage facilities. Proposed Mitigation Measure 14b requires lessees to consult with the NSB and AEWK to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures which could be implemented. Proposed Mitigation Measure 21 prohibits the siting of facilities within one-half mile of the banks of the main channel of the Colville, Canning and Sagavanirktok, Kavik, Shaviovik, Kadleroshilik, Echooka, Ivishak, Kuparuk, Toolik, Anaktuvuk and Chandler Rivers and within 500 feet of fishbearing streams, to the extent feasible and prudent. Onshore oil spills are much easier to contain and clean up than offshore spills. Therefore, it is important to contain onshore spills before they reach water. Chapter Six of the Finding includes a discussion of oil spill response issues and cleanup techniques. State and federal laws require response equipment to be immediately accessible and require operators to prepare an extensive oil spill contingency plan prior to beginning their activities. Spill prevention is extremely important, and one section of the spill contingency plan for each project contains a description of prevention measures that will be used for that project. One important prevention device is the blowout prevention equipment that each well must have.</p>
<p>We request that to mitigate impacts to the Arctic environment the state work with local residents to ensure that industry activities are consistent with their interests.</p>	<p>Measure 14 has been rewritten as a result of an elevation from the NSB. See response to NSB letter of 12/4/97 for the text of measure 14.</p>

Appendix A: Comments and Responses

<p>We support onshore oil exploration and development over offshore because onshore activities utilize known technology, have decades of successful experience, present lower levels of risk, and cause less interference with fish and wildlife and traditional subsistence hunting activities.</p>	<p>Sale 87 is an onshore sale. Mitigation measures developed for the sale are intended to avoid pollution of offshore areas as a result of onshore activities.</p>
<p>We join the NSB in supporting environmentally sound and properly regulated oil development, and in requiring that all North Slope oil development activities be carefully planned and conducted in a manner that protects the land and the sea, the environment, waterfowl, fish and wildlife and marine mammals.</p>	<p>As a balancing agency, DO&G believes that oil and gas development can occur in a manner that will protect the ecosystem. The best interest finding recognizes the extraordinary environmental values of the North Slope. In addition to NSB municipal code, ACMP reviews, and federal wildlife protection laws, mitigation measures ensure that natural resource values will be maintained. Virtually all of Sale 87's mitigation measures have been designed to protect fish and wildlife resources and habitats, as well as the subsistence hunting and fishing.</p>

<p align="center">Trustees for Alaska, Peter Van Tuyn, 12/5/97</p>	
<p>The importance of a cumulative effects analysis for this sale cannot be understated. Without it, we face the danger of conducting environmental reviews on a case-by-case basis without consideration of the true impacts. Initial approval of a project creates momentum toward development that can be very difficult to check. ADNR should analyze the effects of existing development on the environment including air, water and coastal habitats and consider how new development will further impact the environment.</p>	<p>Fish, wildlife, habitats and human uses of the Sale 87 region are described in Chapters Two, Three, and Four. Effects of oil and gas activities are discussed in Chapter Five. AS 38.05 requires that the division discuss the cumulative effects of Sale 87 and subsequent oil and gas activities on habitats, fish and wildlife populations and human use of the sale area. Section B of Chapter Five discusses the reasonably foreseeable cumulative effects of Sale 87 in considerable detail, including effects on air and water quality and habitats.</p>

Before ADNR can analyze the cumulative effect on air quality it should look to readily obtainable information about pollutant emissions in and around the sale area. TFA cites the EPA's Toxics Release Inventory for Alaska and ADEC's database of contaminated sites. ADNR must also look at the list of "water quality impaired" waterbodies in Alaska. ADNR must then analyze this information.

ADNR agrees that it is appropriate to consider readily obtainable available information and it has analyzed the submitted information prior to issuing this best interest finding. However, this does not mean that ADNR must discuss in the body of the best interest finding, every source, no matter how tenuous its relevance or materiality to the lease sale decision. Lists such as those cited by Trustees may or may not contain usable and useful information. If these lists contained sufficient information to determine that air or water pollution levels in a certain area were close to exceeding permissible levels, they might be relevant to a specific enforcement action but not to a lease sale which in itself authorizes no activities or facilities. Furthermore, a list of point sources of pollution existing at the time of the lease sale will quite likely be different at the point in time that a lessee actually proposes to build any facility. The Alaska Toxics Release Inventory (TRI) Trustees attached to its letter does not provide information that would be useful or material to ADNR in determining whether or not a lease sale on the North Slope (or anywhere else in Alaska, for that matter) is in the state's best interest. First, the data are almost three years old. There are no North Slope facilities on the top ten list for total releases. The TRI does not include discharge information from exploration, production or pipeline facilities. The "inventory" lists the top five chemicals involved in air/land/water releases, yet gives no information on the facilities or activities that generated them or the repercussions of such releases. The DEC "database" of contaminated sites, also attached to Trustees's letter, is an eleven-page list of addresses, incident identification numbers, project managers' names and other routine bureaucratic information. Contaminated sites include grocery stores, dry cleaning establishments, military installations and miscellaneous businesses throughout the state. There are also a number of oil and gas drilling sites on the list.

Appendix A: Comments and Responses

With such information before the leases are sold, ADNR will have the ability to place in the lease a condition that only a specified percentage of additional air emissions will be allowed to affect the North Slope airshed. This puts the public and industry on notice before the lease sale of the level of environmental impact the government will allow.

Again, as noted above, the information cited by Trustees, even if it were complete, is not useful as a planning tool. The overall air and water quality in the sale area is of material importance to ADNR, as are the regulatory mechanisms in place to ensure compliance with environmental standards. According to DEC, air quality throughout the proposed Sale 87 area is very good, with concentrations of regulated pollutants well below the maximum allowed under the National Ambient Air Quality Standards. If leases sold as a result of the sale are ever developed, limitations on nitrogen dioxide, sulfur dioxide and total suspended particulate matter will be imposed on industrial sources under the provisions of the Prevention of Significant Deterioration Program administered by EPA. The 1970 Clean Air Act established air quality programs to regulate air emissions from stationery, mobile and other sources that pose a risk to human health and the environment. ADEC monitors compliance with regulations and air quality standards through annual inspections and uniform enforcement procedures. The agency issues operating permits to existing major facilities incorporating all applicable requirements, and issues construction permits to new large facilities and for expansion of existing facilities. It is not possible to predict at the lease sale stage, which does not authorize exploration or development permits, the amount of pollutants that could be produced. All industrial emissions must comply with the Clean Air Act (42 U.S.C. §§ 7401-7642) and state air quality standards. 18 AAC 50 provides for air quality control including permit requirements, permit review criteria, and regulation compliance criteria. 18 AAC 50.300 sets up standards for air quality at certain facilities, including oil and gas facilities, at the time of construction, operation or modification. As oil and gas development proceeds, ADNR will rely on relevant statutes and regulations to assure that pollution arising from that development will remain within established limits.

Appendix A: Comments and Responses

	<p>ADNR has consulted ADEC's proposed 1998 list of surface waters not expected to meet state water quality standards ("Section 303(d) list" prepared to meet a requirement of the federal Clean Water Act). No North Slope waters are listed on the Section 303(d) list. The Nearshore Beaufort Lagoons from the Sag River to Simpson Lagoon had been on the list previously for temperature and salinity; however, causeway breaching appears to have improved habitat conditions. The area continues to be monitored. Based on this, ADNR concludes that water quality on the North Slope is good. The federal Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) to permit discharges of pollutants into U.S. waters by "point sources," such as industrial and municipal facilities. In Alaska, the U.S. Environmental Protection Agency issues NPDES permits, designed to maximize treatment and minimize harmful effects of discharges as water quality and technology improvements are made. ADEC certifies that these discharge permits will not violate the state's water quality standards. Facilities send regular discharge reports to both the EPA and ADEC. Neither agency tabulates the data, which makes it unusable for this analysis.</p>
<p>Perfect information on all possible effects of development does not exist. However, ADNR should attempt to gather and analyze what data does exist. In seeking information and not finding it, ADNR identifies one area where information is lacking. This serves to put expert state and federal agencies and others on notice that such information would be useful.</p>	<p>ADNR does gather and analyze relevant data. In addition to its own considerable research efforts, ADNR conducts an extensive public outreach program before each sale to obtain information. ADNR issues three calls for information prior to a sale. For Sale 87 ADNR specifically asked for information on fish and wildlife in the sale area; current and project uses; information on climate, geography and potential geophysical hazards; characteristics of local communities; air and water quality; and, and the reasonably foreseeable effects of leasing on subsistence and other uses, on municipalities and other communities, and on the environment. This call was sent to everyone on the Sale 87 mailing list, including members of the public, industry and federal, state and local government agencies. ADNR evaluated all of the information provided to determine which was material to its best interest finding.</p>

Appendix A: Comments and Responses

<p>In its cumulative effects analysis, ADNR merely provides an incomplete list of potential activities which may occur as a result of an oil and gas lease sale, and the laws that may apply to such activities and development in the sale area. This information is meaningless as a planning tool. Unless it is used to actually analyze the cumulative effects of the lease sale, it is also legally deficient.</p>	<p>DO&G stands by its cumulative effects analysis as meeting the statutory requirements of AS 38.05.035(g). ADNR has reviewed the reasonably foreseeable cumulative effects of oil and gas exploration, development, production, and transportation on the sale area as required by AS 38.05.035. The finding discusses the laws and regulations that are intended to avoid adverse effects and presents mitigating measures to further provide protection for the environment while balancing this need for protection with the positive economic effect that may result. These factors are material to the analysis as to whether this decision is in the best interests of the state.</p>
<p>We encourage ADNR to include for Sale 87 results from the Sale 85 stakeholders such as 1/2 mile stream setbacks and encouraging lessees to reduce CO2 emissions.</p>	<p>Adopted. See Mitigation Measure 21 and Lessee Advisory 12.</p>

2. Comments prior to the Preliminary Best Interest Finding

This section of the appendix includes a summary of comments regarding Sale 87, North Slope Areawide prior to the Preliminary Best Interest Finding, and the ADNR response to those comments.

Comments submitted in response to:

- Call for Comments, Proposed State of Alaska Oil and Gas Lease Sales for 1996-1997, July 21, 1992.
- Call for Comments, Proposed State of Alaska Five-Year Oil and Gas Leasing Program, July 7 1994.
- Call for Comments, Proposed Oil and Gas Lease Sale 87, North Slope Foothills, January 23, 1995.
- Amendment to Five-Year Oil and Gas Leasing Program, January 16 1996.
- Proposed Oil and Gas Lease Sale 87, North Slope, May 23, 1996.

State Agencies

Alaska Department of Fish and Game, A. Ott, 4/5/97

1. Provides information on anadromous fish species in the proposed sale 87 area.

This information has been incorporated into the preliminary finding.

2. To the extent feasible and prudent, facilities will not be sited within one-half mile (0.8 km) of the banks of the main channels of the Colville, Canning, and Sagavanirktok Rivers; within one-quarter mile (0.4 km) for the Shaviovik, Kavik, Kadleroshilik, Echooka, Ivishak, Kuparuk Rivers, Toolik, Anaktuvuk and Chandler rivers; and that facilities will not be sited within 500 ft. (152 m) of all other fish-bearing streams and lakes. Similar setbacks were incorporated by DO&G for Cook Inlet Sale 85A. These facility set-backs would protect important riparian habitat, reduce disturbance to riparian species, increase protection of resident and anadromous fish, decrease the potential for oil spill damage, and provide for continued public access to lakes and streams.

Adopted. proposed Mitigation Measure 21 reads:

To the extent feasible and prudent, onshore facilities other than docks, or road and pipeline crossings, will not be sited within 500 feet of fishbearing streams. Additionally, to the extent feasible and prudent, facilities will not be sited within one-half mile of the banks of the main channel of the Colville, Canning and Sagavanirktok Rivers and within one-quarter mile of the banks of the Kavik, Shaviovik, Kadleroshilik, Echooka, Ivishak, Kuparuk, Toolik, Anaktuvuk and Chandler Rivers. Essential facility siting will be allowed in buffer areas in those instances where no other suitable sites are available. Facilities will be not be sited within 500 feet of all other fishbearing waterbodies unless the Director, after consulting ADF&G, determines that such facility restrictions are not feasible or prudent. Road and pipeline crossings must be aligned perpendicular or near perpendicular to watercourses.

3. Airstrips should be included as facilities that may not be sited within stream buffers, due to their potential for significantly disrupting and disturbing bird nesting, brood-rearing, feeding, molting, and staging.

The measure states that the siting of onshore facilities "other than docks, or road and pipeline crossings ... " is prohibited within buffer areas. Thus, airstrips would be included as onshore facilities subject to the prohibition.

4. Additionally, as currently written, proposed Mitigation Measure 21 could be interpreted to mean that roads aligned parallel to fish-bearing streams and lakes would be allowed within the stream buffers. The word "road" should be replaced with "road crossing."

5. Lessee advisory 8 should be returned to the permit term status of previous sales. Additionally, the oil storage facility buffer should be expanded from 100 ft. to 500 ft. in order to be consistent with Mitigation Measure 23. LA 8 should state that a 500 foot set-back from all fish-bearing waters will be required for all facilities. Additionally, ADF&G should be added to the consultation provision in LA 8, because of the relationship between this term/advisory and the measure addressing stream setbacks.

The suggested change regarding road crossings is unnecessary, because the final sentence of proposed Mitigation Measure 21 clearly states that road and pipeline crossings must be aligned perpendicular or near perpendicular to watercourses.

Permit-level requirements that are already covered by existing law are placed in the Lessee Advisory section. Lessee Advisories generally are those terms enforced by agencies other than ADNR. ADF&G will not be added to the consultation requirement because that would broaden the scope of the measure beyond its intent. The intent of the measure is to ensure that proposed operations are consistent with oil spill prevention regulations designed to ensure that the quality of waterbodies is maintained. Lessee Advisory 8b reads:

Buffer zones of not less than 500 feet will be required to separate onshore oil storage facilities (with a capacity greater than 660 gallons) and sewage ponds from freshwater supplies, streams, and lakes and key wetlands unless the Director after consultation with ADEC, determines that such a requirement is not feasible or prudent. Reserve pits, if used must be impermeable and otherwise fully contained through diking or other means.

6. An important lease term regarding abandonment and rehabilitation of sites included in earlier sales has been deleted. Rehabilitation is necessary to return the site to a condition where environmental contaminants are not present, and where surface flow, water movements, or currents approximate pre-disturbance conditions. Without the following term, the federal government will have sole control over site rehabilitation or restoration, to the exclusion of state concerns. Therefore, the following language should be adopted as a lease mitigation measure:

“Upon abandonment of drilling sites, all buildings, erosion armament, production platforms, pipelines or other facilities must be removed and the site rehabilitated unless the Director, DO&G, after consultation with ADF&G and ADEC, determines that such removal and rehabilitation is not in the state’s best interest.”

The information about site rehabilitation, described in Paragraph 21 of the Sample Oil and Gas Lease Contract, should be developed and included as a lease term. In this, rehabilitation would be defined as a final site closure term. Removal of gravel from abandoned roads and pads should be included in the definitions.

7. Recommends there be no surface entry within one-half mile of identified Dolly Varden overwintering and spawning areas.

8. A permit term similar to that included in Sale 80 should be included for peregrine falcons.

ADF&G has requested that paragraph 21 of the lease contract, which describes abandonment and rehabilitation of roads, pads, wells, and other improvements, should be developed and added as a “lease term” in order to provide for site rehabilitation. Lease paragraph 9(e)(3) requires lessees to include with their plan of operation plans for rehabilitation of the affected leased area after completion of operations or phases of those operations. The fact that the lease contract contains paragraphs 9 and 21 makes them lease measures. It would be unnecessary to have measures addressing the same issue in both the lease contract and in the mitigation measures which are attached to that contract.

ADNR is currently reviewing work completed by a working group that was formed in 1991 (consisting of AOGA, DO&G, DL, ADF&G, and ADEC) to address this issue. The original effort was put on hold pending resolution of tax issues.

DO&G has added Lessee Advisory 5c which reads:

To minimize impacts on Dolly Varden (arctic char) overwintering areas, permanent, staffed facilities must be sited to the extent feasible and prudent outside identified Dolly Varden (arctic char) overwintering areas.

DO&G has added Lessee Advisory 5b which reads:

Peregrine falcon nesting sites are known to occur in the proposed Sale 87 area. Lessees are advised that disturbing a peregrine falcon nest violates federal law. Lessees are required to comply with the federal resource recovery plan for the arctic peregrine falcon.

9. Lessees should be required, rather than encouraged, to prepare and implement both grizzly bear and polar bear interaction plans. DO&G has stated in previous sale documents that it has no authority to require polar bear interaction plans. However, grizzly bears are a species for which the state has jurisdiction. Therefore, DO&G should require lessees to prepare and implement grizzly bear interaction plans.

In the interests of health and safety, it is prudent to prepare and implement bear interaction plans for operations proposed to take place in bear habitat. The subject of requiring bear interaction plans was decided at an elevation of the issue for Sale 80 between DO&G and ADF&G. It is not logical to require lessees to prepare and implement grizzly bear interaction plans prior to project proposal. If a project is proposed that includes activities in close proximity to areas frequented by bears, DO&G encourages the lessee through proposed Mitigation Measure 20c, to prepare and implement interaction plans. At that project-level, ADF&G has the authority to require interaction plans. Further, ADF&G, not ADNR has the staff and technical experience to evaluate the appropriateness and content of such plans. A decision was made via the Sale 80 elevation that state policy remain to encourage rather than require the preparation and implementation of bear interaction plans. ADF&G agreed to the modified language of Measure 20. Measure 20 applies to both polar bears as well as grizzly bears.

Protection of polar bears is regulated under the federal Marine Mammal Protection Act (MMPA). In 1993, amendments to the MMPA made the USF&WS responsible for the conservation of polar bears in Alaska. These amendments allowed for the incidental, but unintentional "take" of small numbers of polar bears. ("Take", as defined by the MMPA, means to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal. "Harass" is defined to mean any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild; or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.)

10. Permit Term 20 for Lease Sale 80, Shaviovik, should be included in proposed Sale 87 mitigation measures. Given the need for (and often limited distribution of) gravel for development projects, lessees may desire to use gravel from barrier islands, tidelands, submerged lands, lagoons, and nearshore sources. The term should prohibit gravel extraction from barrier islands and prohibit gravel extraction from tidelands, submerged lands, lagoons, and nearshore areas unless the Director, DL, finds in consultation with ADF&G and ADEC, that on the basis of scientific evidence, gravel extraction in these areas will not adversely affect the environment or that no alternative feasible and prudent gravel source exists.

To comply with the requirements of the “take” regulations, oil and gas activities in Important Habitat Areas in the Beaufort Sea are subject to a Letter of Authorization (LOA) from the USF&WS Regional Director of the Alaska Region. The decision to request a LOA is up to the individual operator, although they are liable for incidental takes in the absence of a LOA. LOA’s specify terms and conditions appropriate for the conservation of polar bears, such as interaction plans and detection efforts. Through the LOA, USF&WS has the authority to require and specify the type of interaction plans. LOA’s are tailored to the individual project and take into consideration factors including the time period and specific location where the activity is to take place.

See Lessee Advisory 1. Sale 80 Term 20 is enforced through NSBCMP policies 2.4.5.1 and 2.4.5.2 and NSB Code §19.70.050(J) & (R). Substantial alteration of shoreline dynamics is prohibited. The NSBCMP policies and code will only permit mining and gravel extraction in the coastal area when a lessee can establish (1) there is a significant public need; (2) they have rigorously explored and objectively evaluated all feasible and prudent alternatives; and (3) no feasible and prudent alternative exists. They additionally require evaluation of such proposals with respect to type of extraction operation, location, possible mitigation measures, and season so as to lessen, to the maximum extent practicable, environmental degradation of coastal lands and waters. Therefore, it is unnecessary for DO&G to adopt the suggested addition.

Alaska Department of Fish and Game, A. Ott, 11/22/96

1. Provides updated information on the Teshekpuk caribou herd.

This information has been incorporated into the PBIF.

2. As with previous oil and gas lease sales on the North Slope, we are concerned about the cumulative effects of exploration and development on fish and wildlife resources and their uses by local residents. Planning for this lease sale should include a commitment by the ADNR to reviewing problems encountered and successes achieved in avoiding and mitigating impacts (including cumulative impacts) with its existing mitigation measures and stipulations, and developing any new strategies that might be needed. Initially, the ADNR should secure funding for the development of baseline subsistence and socioeconomic data for the communities most directly affected by this proposed sale, and then establish a process for measuring changes consequent to exploration and development in the sale area. We recommend the ADNR provide funding for and work with the ADF&G Division of Subsistence to carry out these recommended tasks. We also recommend that consultation with local communities be incorporated into the planning for future sales. This consultation should include discussion of problems the communities experienced that were or are perceived to have been associated with oil and gas activities, as well as successful actions taken to mitigate these problems through stipulations or other measures.

An important lease term regarding abandonment and rehabilitation of sites included in earlier sales has been deleted. Rehabilitation is necessary to return the site to a condition where environmental contaminants are not present, and where surface flow, water movements, or currents approximate pre-disturbance conditions. Without the following term, the federal government will have sole control over site rehabilitation or restoration, to the exclusion of state concerns. Therefore, the following language should be adopted as a lease mitigation measure:

“Upon abandonment of drilling sites, all buildings, erosion armament, production platforms, pipelines or other facilities must be removed and the site rehabilitated unless the Director, DO&G, after consultation with ADF&G and ADEC, determines that such removal and rehabilitation is not in the state’s best interest.”

DNR is committed to reviewing problems and successes associated with lease sale mitigation measures. This is done through both internal review and requests for public, agency, and local government comments. ADNR, like most state agencies, has had to cope with budget cuts over the last few years and more cuts are anticipated in the future. Therefore, we are unable to provide funding to the Division of Subsistence. ADNR is interested in exploring with ADF&G what other steps, short of funding baseline studies, could be taken to evaluate the effectiveness of current subsistence mitigation measures. Communities are invited to participate in the planning process through the calls for comments and may also schedule public hearings. DO&G issued five calls for comments on proposed Sale 87 and specifically requested comments on subsistence use. Based on these, and comments from previous sales we have modified mitigation measures. For example, the subsistence harvest protection measure (proposed Mitigation Measure 14) has been expanded to require operators to consult with the NSB and the affected subsistence community and discuss potential conflicts with siting, timing, and methods of proposed operations. Proposed Mitigation Measure 10 has been modified to clarify the intent to prohibit solid-fill structures which may alter nearshore circulation patterns. At the request of ADF&G, facility siting buffers along major rivers of the North Slope have been expanded from one-quarter mile to one-half mile and facility siting buffers along other fishbearing waterbodies have been expanded from 100 feet to 500 feet.

See response to comment 6 in the ADF&G letter of 3/5/97.

Recommends tracts containing identified Dolly Varden (Arctic char) overwintering areas be deleted from the sale.

See response to comment 7 in the ADF&G letter of 3/5/97.

To the extent feasible and prudent, facilities will not be sited within one-half mile (0.8 km) of the banks of the main channels of the Colville, Canning, and Sagavanirktok Rivers; within one-quarter mile (0.4 km) for the Shaviovik, Kavik, Kadleroshilik, Echooka, Ivishak, Kuparuk Rivers, Toolik, Anaktuvuk and Chandler rivers; and that facilities will not be sited within 500 ft. (152 m) of all other fish-bearing streams and lakes. Similar setbacks were incorporated by DO&G for Cook Inlet Sale 85A. These facility set-backs would protect important riparian habitat, reduce disturbance to riparian species, increase protection of resident and anadromous fish, decrease the potential for oil spill damage, and provide for continued public access to lakes and streams.

See response to comment 2 in the ADF&G letter of 3/5/97.

Airstrips should be included as facilities that may not be sited within stream buffers, due to their potential for significantly disrupting and disturbing bird nesting, brood-rearing, feeding, molting, and staging.

See response to comment 3 in the ADF&G letter of 3/5/97.

A term regarding protection of spectacled eiders should be applied to this sale.

Lessee advisory 5a reads:

Lessees shall comply with the Recommended Protection Measures for Spectacled Eiders developed by the USF&WS to ensure adequate protection of spectacled eiders during the nesting and brood rearing periods.

A permit term regarding the construction of elevated pipelines to insure the free passage of moose should be included in the mitigation measures.

Proposed Mitigation Measure 8 includes caribou and other large ungulates. It reads:

Pipelines shall be designed and constructed to avoid significant alteration of caribou and other large ungulate movement and migration patterns. At a minimum, above ground pipelines shall be elevated five feet, as measured from the ground to the bottom of the pipe, except where the pipeline intersects a road, pad, or a ramp installed to facilitate wildlife passage. ADNRC may, after consultation with ADF&G, require additional measures to mitigate impacts to wildlife movement and migration.

Alaska Department of Fish and Game, A. Ott, 6/30/95

Provides information on fisheries, terrestrial wildlife and subsistence within the propose sale area.

This information has been incorporated into the PBIF.

Federal Agencies

U.S. Fish and Wildlife Service, P. Sousa, 2/28/97 --

Recommends deletion of tracts used by caribou of the Central Arctic Herd, specifically tracts within concentrated calving areas. There are a number of lines of evidence which suggest long-term negative impact of oil and gas development on female caribou during the calving and post-calving period. In the past DO&G has responded to these data by stating that there is sufficient habitat available at the current population level. If ADNR believes that such action is premature, the agency is obligated to present the logic of its case and propose an alternative approach that addresses the issue.

The Central Arctic Herd (CAH) ranges throughout the entire proposed sale area. DO&G believes that acute adverse impacts to calving caribou can be mitigated at the project proposal and design phase through lease sale mitigation measures, permit-specific stipulations, and thorough review of project proposals via the ACMP process. DO&G does not believe that deletion of tracts used by calving caribou is necessary to ensure the long-term viability of the herd for several reasons. Caribou calving areas change over time. It is not clear that acute disturbances from oil development have a population level effect on caribou. A reduction in fecundity may be correlated with the presence of oil field infrastructure, but no causal relationship is evident. Effects of modern oil field development is both quantitatively and qualitatively different than effects of older fields. Furthermore, population dynamics of caribou are driven by a multitude of factors other than habitat availability and nutritional stress caused by disturbance.

ADF&G has throughout the years of oil and gas lease sales, identified core calving areas of the CAH for inclusion in best interest findings. A review of past lease sale documents and other references reveals that such areas are not stationary (See State Oil & Gas Lease Sales 39, 45A, 48/48A, 51, 54, 52, 70A, 64, 80, and 86A). References depicting caribou calving areas include (AEIDC, 1975)(NSBCMP, 1983)(ADF&G, 1986)(Shideler, R.T., 1986)(USF&WS, 1986)(NOAA, 1987)(Cameron, 1994a)(Lawhead, et al., 1997)). Part of this movement may be explained in the variability in caribou distribution from year to year. Another reason may be differences in sampling method, survey area, and timing of surveys among researchers. In the last two decades, the distribution of caribou during calving periods has indeed shifted about in the Kuparuk development area (Cameron, 1995, citing to Smith and Cameron, 1992). The USF&WS (1986) presents a clear portrait of a shifting core calving area for the Porcupine Caribou Herd over the time period 1972 to 1985, although it should be noted that differences exist among the two herds with respect to herd size and range, and fidelity to calving grounds.

While it may be true that calving caribou of the CAH were observed in fewer numbers where the Milne Point road now lies, a conclusion that a shift in distribution equates to long-term negative impact cannot be easily made. Similarly, the occurrence and incidence of lateral movements does not appear to be a clear indicator of long-term viability of the CAH population. USF&WS, citing Cameron (1995) suggests that oil field disturbance leads to reduced nutritional intake of females, which leads to lower body condition, and eventually an increase in reproductive pauses (a year where a calf is not produced). Dr. Cameron reports that fecundity of females was higher in the undeveloped portion of the coastal plain, east of the Sagavanirktok River, as compared to the developed portion west of the river. However, it is not clear that oil development per se is the principal factor contributing to this disparity. The author notes that east-west differences in population density and habitat quality may also be contributing variables other than disturbance from oil field activity. Further, an increase in reproductive pauses may not necessarily be a vestige of long-term adverse effect on caribou populations. In a 1994 paper (abstract), Dr. Cameron writes, "Periodic infertility, as a response to nutritional stress, may enhance long-term reproductive performance in caribou and other ungulates."(Cameron, 1994b)

DO&G has not found sufficient evidence to conclude that caribou population size on the North Slope is a function of habitat availability. Other factors, such as disease, predation, and weather also play a role in caribou population dynamics. It is unlikely that oil field disturbance is a dominant factor which would cause a reproductive decline of the CAH. As described in Chapter Three, the population of the CAH rose steadily throughout the period of oil development on the North Slope.

Oil field disturbance, unlike other factors, can be avoided or reduced by human controls on facility design and operation. Albeit, new discoveries are smaller, the total acreage requirements to develop petroleum resources today are a fraction of what was needed to develop Prudhoe Bay and Kuparuk fields. For example, a drill site pad that occupied approximately 65 acres of surface area in the 1970s now covers less than 15 acres. Thus, estimates of the impacts of modern oil field development on caribou must not rely too heavily on comparisons with effects of older fields. Improvements in oil field design (pipeline and road layout, facility consolidation, elevation or burial of pipelines) and operations (aircraft and traffic restrictions) are likely to result in a significant reduction in the disturbance factor for caribou encountering new fields. Proposed Sale 87 tracts, if developed, will benefit from modern oil field development technology.

Observations and research findings are important in assessing the effects of oil and gas development on caribou. DO&G continues to review and incorporate all relevant data, observations, and information regarding the impacts of oil and gas activities on the long-term health of caribou herds, including the CAH. DO&G believes that acute adverse impacts to calving caribou can be mitigated at the project proposal and design phase through lease sale mitigation measures, permit-specific stipulations, and thorough review of project proposals via the ACMP process. Chapter Five includes a discussion of effects of oil and gas activities on caribou and subsequent mitigation of adverse effects. For more detail on proposed Sale 87 measures to protect caribou, see response to USF&WS letter of 8/21/92.

Lessees should be aware that key wetlands are generally presumed to be: fish-bearing streams and lakes, ponds/lakes with emergent sedge/grass, basin wetland complexes, saline meadow (i.e., "salt-marsh"), riparian zones (especially riparian scrub).

Wetlands and some wetland classification schemes are described in Chapter Three. Wetlands are lands where saturation with water is the dominant factor in determining the nature of soils and the types of plant and animal communities living in the soil and on the surface. Wetlands occur where the water table is at or near the surface, the land supports at least periodically water-loving plants (hydrophytes), and the substrate or surface is saturated with water or covered by water at some time during the growing season each year (Cowardin, et al., 1979:3). Non-wetland habitats include pingos, high-top polygons, steep river banks, gravel bars, and dunes (Carpenter, 1997).

Under Mitigation Measure 5, Key wetlands are those wetlands that are important to fish, waterfowl, and shorebirds because of their high value or scarcity in the region. Under Lessee Advisory 3, lessees are advised that the wetlands referred to in Mitigation Measures 5, and 18 are based on a classification system developed by Bergman et al (USF&WS Resource Publication 129, 1977 Waterbirds and Their Wetland Resources in Relation to Oil Development at Storkersen Point, Alaska). Lessees are advised that the state may adopt or approve the use of an alternative wetlands classification system in the future, however, the protective nature of the wetlands mitigation measures developed for this and other oil and gas lease sales will remain consistent regardless of the wetlands classification ultimately selected.

The Lease Sale document should identify generally applicable practices that minimize environmental impacts. In that regard, we call your attention to the 1994 report entitled "Stream crossing design procedure for fish streams on the North Slope coastal plain of Alaska," prepared by G..N. McDonald & Associates for BP Exploration (Alaska) Inc. and the Alaska Department of Environmental Conservation. The referenced document provides step-by-step guidance on design of cross-drainage structures, both culverts and bridges. ADNRR should require lessees to follow these guidelines.

ADF&G is the permitting authority for fishbearing streams. According to ADF&G, there are always new areas and new technologies and methods for crossing design procedures (e.g., flow model developed by Shannon and Wilson for the Alpine project), so some degree of flexibility for alternative approaches is warranted. Therefore ADNRR will not *require* lessees to follow these guidelines. However, ADF&G strongly encourages the use of the above referenced design approach, and when followed by applicants, permit issuance by the department is likely.

Spectacled eiders are not uniformly distributed over the proposed sale area. For much of the area, relatively inexpensive aerial surveys could document the absence of this species, relieving the lessee of the burden of more expensive site specific ground searches.

DO&G believes that surveys to document the presence of a particular species are best left to the plan of operations stage. This is particularly true in an areawide sale such as proposed Sale 87. The proposed sale area encompasses nearly 8,000 square miles. It is likely that much of this area will never be leased or explored, let alone developed. At the plan of operations stage, the relevant regulatory agencies can fully consider the environmental impacts of specific activities.

There is a need for improved communication between ADNR and the Service with regard to water rights. We request notification of all applications for Temporary Water Use Permits involving the diversion, impoundment, or withdrawal of water from rivers, streams, lakes, wetlands, or ground water on ANWR, or that form a boundary of ANWR. In addition we request notification of all water right applications and Temporary Water Use Permit applications from surface or ground waters within one mile of ANWR.

We request the following mitigation measure: "Removal of snow cover from fishbearing rivers, streams, and natural lakes shall be subject to prior written approval by ADF&G and the Division of Mining and Water Management." This will ensure that DMWM will review snow cover removal as it might affect related water withdrawals and water rights granted from the specific river, stream, or natural lake.

With the exception of Temporary Water Use permits, notification is already being given to the USF&WS, through coordination with DGC and the Joint Pipeline Office. The request for additional person-specific notification has been forwarded to the DMWM.

The intent of this measure is to protect overwintering fish, not to regulate water withdrawals and water rights. Thus, the recommended change expands the scope of this lease sale mitigation measure beyond its intent, and will not be adopted. ADNR defers to the best professional judgment of ADF&G regarding the effects of snow removals.

U.S. Fish and Wildlife Service, L. Bright, 8/21/92

The proposed sale area includes nesting areas of the threatened arctic peregrine falcon. Activities by lessees will require consultation with the Service under Section 7 of the Endangered Species Act.

Recommend the Colville River delta be deleted. If leased we support the inclusion of mitigation measures to protect water birds.

Recommend no permanent facilities, other than limited transportation crossings, be constructed within 3/4 mile of mean high water of the Colville River, and 1,500 feet of the mean high water of the Itkillik, Kuparuk, Toolik, Sakonowiyak, Ugnuravik, Miluveach, and Kachemach rivers and East Creek.

See response to comment 8 in the ADF&G letter of 3/5/97.

ADNR has worked with ADF&G to develop mitigation measures to minimize the impacts of development on fish and wildlife throughout the proposed sale area, including the Colville River Delta. Mitigation measures that will protect water birds include: Proposed Mitigation Measure 5, which requires lessees to minimize the impact of industrial development on key wetlands. Proposed Mitigation Measure 21, restricts, to the extent feasible and prudent, the siting of facilities within one-half mile of the main Channel of the Colville River. Lessee Advisory 6a seasonally restricts aircraft overflights by an altitude of 1,500 feet and a lateral distance on one mile from identified brant, tundra swan, king eider, common eider, and yellow-billed loon nesting and brood rearing habitat.

See response to comments 2, 3, and 4 in the ADF&G letter of 3/5/97.

Recommend deleting caribou core calving areas from the proposed sale. At a minimum, special conditions should be developed for calving areas.

Caribou calving areas need not be deleted from leasing in order to ensure the long-term viability of herds. See response to USF&WS letter of 2/28/97. In addition to mitigation measures, permit stipulations may be applied to projects where there is a potential to affect calving caribou through the ACMP review process. Mitigation measure 8 states that pipelines shall be designed and constructed to avoid significant alteration of caribou and other large ungulate movement and migration patterns. At a minimum, above ground pipelines shall be elevated five feet, as measured from the ground to the bottom of the pipe, except where the pipeline intersects a road, pad, or a ramp installed to facilitate wildlife passage. ADNR may, after consultation with ADF&G, require additional measures to mitigate impacts to wildlife movement and migration. Under Lessee Advisory 6b, all aircraft should maintain an altitude of greater than 1,500 feet or a lateral distance of one mile, excluding takeoffs and landings, from caribou and muskoxen concentrations. Under Lessee Advisory 10, lessees are encouraged in planning and design activities to consider the recommendations for oil field design and operations contained in the final report to the Alaska Caribou Steering Committee: Cronin, M. et al, 1994. "Mitigation of the Effects of Oil Field Development and Transportation Corridors on Caribou." As stated in Mitigation Measure 8, special conditions may be developed to mitigate adverse effects on calving caribou at the plan of operations stage.

National Park Service, R. Barbee, 7/3/95

The lease sale abuts the boundaries of Gates of the Arctic National Park and Preserve. Oil and gas operations are incompatible with the purpose for which the park was developed.

The sale area no longer abuts the boundaries of Gates of the Arctic National Park and Preserve.

U.S. Department of Energy, L. Coburn, 6/22/95

Sale 87 and subsequent offerings could play an instrumental role in the development of other North Slope oil and gas resources. Successful oil and gas exploration and development could contribute to the extended operation of the Trans-Alaska Pipeline. Alaska oil plays a significant role in the world-wide oil market and provides high-quality, high-wage jobs.

The effects of the proposed sale on the state and local economy are discussed in "Chapter Five."

Local Government

North Slope Borough, J. Kaleak, 8/21/92

There is a lack of comprehensive planning for the state lands involved in Sale 87. It appears that ADNR is managing state lands on the North Slope for a single purpose, the extraction of oil and gas resources. We recommend ADNR schedule and budget for a comprehensive land use planning process.

ADNR has not completed an area plan for the North Slope and one is not scheduled for the near future. Ideally, we would have regional plans in place for all state land, including the North Slope. Planning resources are limited so the department has focused past planning in areas with the greatest conflicts, in areas with the largest blocks of state land, and where other ADNR processes do not adequately address uses of state land. Regional plans do not provide detailed guidelines for oil and gas development. ADNR has relied on the oil and gas leasing process and the NSBCMP to establish such guidelines. This process is better able to deal with the specific issues related to oil and gas exploration, development and production. Also, because these guidelines can be revised for each sale, they are able to address new information and technology. Under AS 38.05.035(e) the Director must prepare a best interest finding which is a written analysis that describes for the public the facts and applicable law which are relevant to the disposal and gives a decision based on these factors. If the proposed activity occurs in a coastal area, AS 46.40 requires that the activity be consistent with the ACMP which includes the NSBCMP. Among the topics that must be considered in a best interest finding are: fish and wildlife species and their habitats in the area; the current and projected uses in the area, including uses and value of fish and wildlife; the reasonably foreseeable cumulative effects of oil and gas exploration, development, production, and transportation on the sale area, including effects on subsistence uses, fish and wildlife habitat and populations and their uses, and historic and cultural resources; lease stipulations and mitigation measures, including any measures to prevent and mitigate releases of oil and hazardous substances, to be included in the leases, and a discussion of the protections offered by these measures.

Oil and support service industries

Alaska Oil and Gas Association, J. Brady, 6/20/95

AOGA supports regularly scheduled lease sales in the area covered by Sale 87; in particular the area north of 70 degrees latitude. This area is near existing infrastructure. We strongly encourage ADNR to offer this area for lease at least once an year. The southern portion of the sale area is a frontier area of relatively low industry interest and could be more efficiently developed through an exploration license.

It is the intent of ADNR to offer the acreage included in this preliminary best interest finding each year, for 10 years, until a new finding is required. AS 38.05.131 prohibits the issuance of an exploration license on land north of the Umiat baseline (approximately 69° 30' N). Once a lease sale is held in the area south of the Umiat baseline (currently scheduled for 2001) that area will be available for exploration licensing.

ARCO Alaska Inc., James M. Davis, 8/21/92

Supports the proposed lease sale and regular scheduling of future sales. Concerned about the trend toward restrictive lease stipulations and plan of operations permits. Decisions on new leasing in Alaska should acknowledge that oil and gas exploration and production have coexisted with environmental values and other uses for over 30 years. Stipulations should respect wildlife and habitat values and other uses without placing an unreasonable burden on environmentally responsible exploration and development.

The mitigation measures presented in this preliminary best interest finding were developed after considering stipulations and terms imposed in other North Slope oil and gas lease sales (Sales 50, 52, 65, 68, 80, 86, and recent comments and testimony on OCS Sale 144); fish and wildlife resource and harvest data submitted by ADF&G; environmental data relating to air and water quality, solid and liquid waste disposal, and oil spills submitted by ADEC. Measures were also developed or modified after considering comments submitted by the public, industry, federal and state agencies, and local government pertaining to this sale. Additional project-specific mitigation measures will be imposed if and when oil and gas lessees submit plans of exploration, operation, or development. Information to lessees relevant to proposed Sale 86 is also presented in the "lessee advisories," section. This section contains important information to lessees and operators regarding the proposed Sale 86 area. It also includes precautions which may apply to post-lease sale activities, and reflect existing local, state, and federal law or policy at the time of the sale. Proposed mitigation measures reflect a balance between environmental and subsistence access concerns, and practical constraints of exploration and development technology.

ARCO Alaska Inc., R. Strode, 6/28/95

ARCO supports regularly scheduled lease sales in the area covered by Sale 87; in particular the area north of 70 degrees latitude. This area is near existing infrastructure and highly competitive. We strongly encourage ADNR to offer this area for lease at least once an year. The southern portion of the sale area is a frontier area of relatively low industry interest and could be more efficiently developed through an exploration license.

Comment noted. See response to AOGA letter of 6/20/95

BP Exploration, E. Zselezky, 8/17/92

BP encourages the frequent scheduling of lease sales by the state of Alaska.

Comment noted.

Phillips Petroleum Company, B. Butterfield, 8/17/92

Supports a timely and regular schedule of lease sales. DO&G should continue its efforts to protect the environment and work with those who feel that oil and gas exploration and development are detrimental.

Comment noted. Proposed mitigation measures are designed to ensure post-sale activities do not adversely impact the environment or result in conflicts between user groups.

Union Texas Petroleum Alaska Corporation, B. Hamilton, 11/1/96

Supports the adherence to a predictable leasing schedule which fosters competition and enables industry to justify the allocation of staff, technology, and expense to evaluate prospective tracts.

Comment noted.

Union Texas Petroleum Alaska Corporation, E. Williams, 6/30/95

Supports proposed Sale 87 as scheduled. Offering these lands on schedule will minimize the costs of delay and will allow for the orderly exploration of state lands.

Comment noted.

Others

Alaska Eskimo Whaling Commission, M. Ahmogogak, 11/20/96

The AEWK has a concern related to impacts resulting from an oil spill. If an oil spill occurs and goes out into the ocean, it will flow directly out to the migration corridor of the bowhead whale. The state should work with local residents to ensure that activities are conducted in a way that is consistent with the interests of the residents of the North Slope.

The likelihood of a large onshore oil spill flowing into the ocean and impacting bowhead whales is very small and has never occurred in over thirty years of North Slope exploration and development. However, the possibility, though very unlikely, does exist and must be addressed. A number of mitigation measures have been adopted to minimize the potential of a large oil spill from a well blowout or pipeline rupture from reaching the Beaufort Sea. Proposed Mitigation Measure 7a requires that pipelines be located so as to facilitate the containment and cleanup of spilled hydrocarbons. Proposed Lessee Advisory 8 requires impermeable lining and diking, or equivalent measures such as double walled-tanks for onshore oil storage facilities. Proposed Mitigation Measure 14b requires lessees to consult with the NSB and AEWK to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures which could be implemented. Proposed Mitigation Measure 21 prohibits the siting of facilities within one-half mile of the banks of the main channel of the Colville, Canning and Sagavanirktok, Kavik, Shaviovik, Kadleroshilik, Echooka, Ivishak, Kuparuk, Toolik, Anaktuvuk and Chandler Rivers and within 500 feet of fishbearing streams, to the extent feasible and prudent. Onshore oil spills are much easier to contain and clean up than offshore spills. Therefore, it is important to contain onshore spills before they reach water. Chapter Six of the Finding includes a discussion of oil spill response issues. State and federal laws require response equipment to be immediately accessible and require operators to prepare an extensive oil spill contingency plan prior to beginning their activities. Spill prevention is extremely important, and one section of the spill contingency plan for each project contains a description of prevention measures that will be used for that project. One prevention device is the blowout prevention equipment that each well must have.

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

Alaska Statutes and Administrative Code Sections

ADNR

- AS 38.05.027 Management of legislatively designated state game refuges and critical habitat areas is the co-responsibility of ADF&G (AS 16.20.050-060) and ADNR. Lessees are required to obtain permits from both ADNR and ADF&G.
- AS 38.35.010-260 Right-of-way leasing for pipeline transportation of crude oil and natural gas is under the control of the commissioner of ADNR. The commissioner shall not delegate the authority to execute the leases.
- AS 38.05.127 Provides for reservation of easements to ensure free access to navigable or public water.
- 11 AAC 53.330 Implementing regulations for the reserving of easements to ensure free access to navigable or public water.
- 11 AAC 83.158(a) A plan of operations must be approved by the commissioner, ADNR, if (1) state owns all or a part of the surface estate, (2) lease reserves a net profit share to the state, (3) state owns all or part of the mineral estate, but the surface estate is owned by a party other than the state, and the surface owner requests such a plan.
- 11 AAC 96.010 Operations requiring permits, including the use of explosives and explosive devices, except firearms.
- 11 AAC 96.140 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/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 the director, DO&G, to approve oil and gas exploration and development activities in the case where the surface estate is not held by the state or is otherwise subject to third party interests, provided the director determines that adequate compensation has been made to the surface estate holder for any damages which may be caused by lease activities.
- AS 38.05.180 Establishes an oil and gas leasing program to provide for orderly exploration and development of petroleum resources belonging to the state of Alaska.
- 11 AAC 96.010-150 Geophysical Exploration Permit provides controls over activities on state lands in order to minimize adverse activities

ADNR/DL

- AS 38.05.075 Establishes leasing procedures under public auction, including tide and submerged lands, bidding qualifications, and competitive or non-competitive bidding methods.
- AS 38.05.850 Authorizes the director to issue permits, rights-of-way or easements on state land for recovery of minerals from adjacent land under valid lease.
- 11 AAC 80.005-055 Pipeline Right-of-way Leasing Regulations.
- 11 AAC 93.040-130 Requires a Water Rights Permit for the appropriation of state waters for beneficial uses.
- 11 AAC 96.010-140 Land use permit activities not permitted by a multiple land use permit or lease operations approval.

ADNR/ DMWM

- 11 AAC 93.210-220 Provides for temporary water use permits and procedures for application.

ADNR/DF

- AS 41.17.082 Alaska Forest Resources Practices Act. Requires that all forest clearing operations and silvicultural systems be designed to reduce the likelihood of increased insect infestation and disease infections that threaten forest resources.
- 11 AAC 95.195 Describes the approved methods of disposal or treatment of downed spruce trees to minimize the spread of bark beetles and reduce the risk of wildfire.
- 11 AAC 95.220 Requires the lessee to file a detailed plan of operations with the state forester.

ADF&G

- AS 16.05.840 A permit is required from ADF&G prior to obstruction of fish passage.
- AS 16.05.870 Provides for the protection of anadromous fish and game in connection with construction or work in the beds of specified water bodies, and calls for approval of plans by the commissioner, ADF&G, for any diversion, obstruction, change, or pollution of these water bodies.
- AS 16.20 Management of legislatively designated game refuges and critical habitat areas.
- AS 16.20.060 The commissioner, ADF&G, may require submission of plans for the anticipated use, construction work, and proper protection of fish and game. Written approval must be obtained.
- AS 16.20.180-210 Requires measures for the continued conservation, protection, restoration, and propagation of endangered fish and wildlife.
- 5 AAC 95.010-990 Fish and Game Habitat Authority.
- 5 AAC 95.420-430 Requires a Special Area Permit for certain activities within a special area, defined as a state game refuge, a state game sanctuary, or a state fish and game critical habitat area.

AOGCC

- AS 31.05.005 Establishes and empowers the Alaska Oil and Gas Conservation Commission.

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

AS 31.05.030(d)(9)	Requires an oil and gas operator to file and obtain approval of a plan of development and operation.
AS 46.03.900(35)	Definition of waters.
AS 46.03.100	Accumulation, storage, transportation and disposal of solid or liquid waste standards and limitations.
20 AAC 25.005-570	Requires a permit to drill to help maintain regulatory control over the drilling and completion activities in the state.
20 AAC 25.140	Requires a Water Well Authorization to allow abandoned oil and gas wells to be converted to freshwater wells and to assure there is no contamination of the fresh water source.
ADEC	
AS 46.03	Provides for environmental conservation including water and air pollution control, radiation and hazardous waste protection.
AS 46.03.100	Requires solid waste disposal permits.
AS 46.03.759	Establishes the maximum liability for discharge of crude oil at \$500 million.
AS 46.03.900(35)	Definition of waters.
AS 46.04.010-900	Oil and Hazardous Substance Pollution Control Act. This act prohibits the 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 with over 5,000 bbl of crude oil or 10,000 bbl of non-crude oil.
AS 46.04.050	Exemption for above-ground storage facilities for under 5,000 bbl of crude oil or 10,000 of non-crude oil.
18 AAC 15	Requires a Certificate of Reasonable Assurance (Water Quality Certification) in order to protect the waters of the state from becoming polluted. Assures that the issuance of a 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 50.300	Sets up standards for air quality at certain facilities including oil and gas facilities at the time of construction, operation, or modification.
18 AAC 60.220	Requires proof of financial responsibility before a permit for operation of a hazardous waste disposal facility may be issued.
18 AAC 60.220-240	Requires a Solid Waste Disposal Permit to control or eliminate detrimental health, environmental, and nuisance effects of improper solid waste disposal practices and to operate a solid waste disposal facility.

18 AAC 60.520	General requirement for containment structures used for disposal of drilling wastes.
18 AAC 72	Requires a Wastewater Disposal Permit in order to prevent water pollution (and public health problems) due to unsafe wastewater disposal systems and practices.
18 AAC 75	Provides for oil and hazardous substance pollution control including oil discharge contingency plan (18 AAC 75.305-.395).
18 AAC 75.005-025	Requirements for oil storage facilities for oil pollution prevention.
18 AAC 75.065-075	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.
DGC	
AS 44.19.155	Establishes and empowers the Alaska Coastal Policy Council.
AS 46.40	Establishes the Alaska Coastal Management Program.
6 AAC 50	Requires the sale to be consistent with the ACMP, including approved district programs.
6 AAC 80.070(b)(3)	Requires that facilities be consolidated to the extent feasible and prudent.
6 AAC 80.070(b)(10)	Requires that facilities be sited to the extent feasible and prudent where development will necessitate minimal site clearing, dredging, and construction.
6 AAC 80.070(b)(11) and(12)	Requires that facilities be sited to the extent feasible and prudent to allow for the 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, avoid adverse effects on natural drainage patterns, and the destruction of important habitat.
6 AAC 85	Establishes guidelines for district coastal management programs.
AS 26.23.195	Establishes the State Emergency Response Commission.
AS 39.50.20	Establishes Hazardous Substance Spill Technology Review Council within State Emergency Response Commission for research, testing spill technologies, and to serve as a clearinghouse for containment and cleanup technology.
AS 24.20.600	Citizens Oversight Council established a five-member council to serve as watchdog of state and federal agencies having responsibility for prevention of and response to oil spills, to help ensure compliance with environmental laws and regulations
NSB	
19.06 - 19.70.060	North Slope Borough land management regulations, planning, and permitting powers.

Federal Laws and Regulations

Clean Water Act (CWA) - 33 U.S.C. §§ 1251-1387

§ 1343 - Corps permit required to excavate, fill, alter, or modify the course or condition of navigable or U. S. waters.

§ 1344 - Discharge of Dredge and Fill

Oil Spill and Hazardous Substances Pollution Contingency Plan - 40 C.F.R. § 300

EPA Regulations - 40 C.F.R.

§ 109 - Criteria for Oil Removal Contingency Plans

§ 110 - Discharge of Oil

§ 112 - Oil Pollution Prevention. 112.7 - Guidelines for implementation of SPCC plan

§ 113 - Liability Limits for Small Onshore Oil Storage Facilities

§ 114 - Civil Penalties for Violation of Oil Pollution Regulations

§ 116 - Designation of Hazardous Substances

§ 117 - Determination of Reportable Quantities for Hazardous Substances

Coast Guard Regulations - 33 C.F.R. §§ 153-157 Oil Spill Regulation

§ 153 - Reporting Oil Spills to Coast Guard

§§ 155-156 - Vessels in Oil Transfer Operations

Water Quality:

EPA Regulations - 40 C.F.R.

§ 121 - State Certification of Activities Requiring a Federal Permit

§ 136 - Test Procedures for Analysis of Pollutants

NPDES Permit System:

EPA Regulations - 40 C.F.R.

§ 122 - NPDES Permit Regulations

§ 125 - Criteria and Standards for NPDES Permits

§ 129 - Toxic Pollutant Effluent Standards

§ 401 - General Provisions for Effluent Guidelines and Standards

§ 435.10-435.12 - Offshore Oil & Gas Extraction Point Source Category

Ocean Dumping:

EPA Regulations - 40 C.F.R.

§§ 220-225, 227-228 - Ocean Dumping Regulations and Criteria

EPA Regulations - 40 C.F.R.

§ 230 - Discharge of Dredged or Fill Material into Navigable Waters

§ 231 - Disposal Site Determination

Army Corps of Engineers (Corps) Regulations - 33 C.F.R.

§ 209 - Navigable Waters

§§ 320-330 - Permit Program Regulations

§ 323 - Discharge of Dredge and Fill

The Fish and Wildlife Coordination Act - 16 U.S.C. §§ 661-666(c)

Allows comment on § 404 permit applications by USF&WS, NMFS, and EPA.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) 42 U.S.C. §§ 9601-9675

EPA Plans - 40 C.F.R.

§ 300 - National Oil and Hazardous Substances Pollution Contingency Plan

Safe Drinking Water Act - 42 U.S.C. § 300

EPA Regulations - 40 C.F.R.

§ 144 - Permit Regulations for the Underground Injection Control Program

§ 146 - Criteria and Standards for Underground Injection Control Program

§ 147 - State Underground Injection Control Program

Coastal Zone Management Act (CZMA) - 16 U.S.C. §§ 1451-1464

NOAA Regulations - 15 C.F.R.

§ 930 - Federal Consistency with Approved Coastal Management Programs

§ 931 - Coastal Energy Impact Program

Solid Waste Disposal Act, as amended by Resource Conservation and Recovery Act (RCRA) - 42 U.S.C. §§ 6901-6991

Clean Air Act (CAA) - 42 U.S.C. §§ 7401-7642

Toxic Substances Control Act - 15 U.S.C. §§ 2601-2655

National Ocean Pollution Planning Act - 33 U.S.C. §§ 1701-1709

National Environmental Policy Act (NEPA) - 42 U.S.C. §§ 4321-4347

Council on Environmental Quality (CEQ) Regulations - 40 C.F.R.

§§ 1500-1508 - Implementing NEPA Procedures

Endangered Species Act (ESA) - 16 U.S.C. §§ 1531-1543

USF&WS Regulations - 50 C.F.R.

§ 17 - Endangered & Threatened Species

§ 402 - Interagency Cooperation

Fish and Wildlife Coordination Act - 16 U.S.C. §§ 661-666(c)

Marine Protection, Research and Sanctuaries Act - 33 U.S.C. §§ 1401-1445

Marine Mammal Protection Act - 16 U.S.C. §§ 1361-1407

Migratory Bird Treaty Act - 16 U.S.C. §§ 703-711

National Historic Preservation Act - 16 U.S.C. § 470

Leases and Permits on Restricted Properties - 25 C.F.R. § 162

Appendix C: Sample Oil and Gas Lease

Competitive Oil and Gas Lease
Form #DOG 9609 (rev. 6/97)

STATE OF ALASKA DEPARTMENT OF NATURAL RESOURCES

Competitive Oil and Gas Lease

ADL No.

THIS LEASE is entered into _____, between the State of Alaska, "the state," and

"the lessee," whether one or more, whose sole address for purposes of notification is under Paragraph 25.

In consideration of the cash payment made by the lessee to the state, which payment includes the first year's rental and any required cash bonus, and subject to the provisions of this lease, including applicable stipulation(s) and mitigating measures attached to this lease and by this reference incorporated in this lease, the state and the lessee agree as follows:

1. GRANT. (a) Subject to the provisions in this lease, the state grants and leases to the lessee, without warranty, the exclusive right to drill for, extract, remove, clean, process, and dispose of oil, gas, and associated substances in or under the following described tract of land:

containing approximately _____ acres, more or less (referred to in this lease as the "leased area"); the nonexclusive right to conduct within the leased area geological and geophysical exploration for oil, gas, and associated substances; and the nonexclusive right to install pipelines and build structures on the leased area to find, produce, save, store, treat, process, transport, take care of, and market all oil, gas, and associated substances and to house and board employees in its operations on the leased area. The rights granted by this lease are to be exercised in a manner which will not unreasonably interfere with the rights of any permittee, lessee or grantee of the state consistent with the principle of reasonable concurrent uses as set out in Article VIII, Section 8 of the Alaska Constitution.

(b) For the purposes of this lease, the leased area contains the legal subdivisions as shown on the attached plat marked Exhibit A.

(c) If the leased area is described by protracted legal subdivisions and, after the effective date of this lease, the leased area is surveyed under the public land rectangular system, the boundaries of the leased area are those established by that survey, when approved, subject, however, to the provisions of applicable regulations relating to those surveys. If for any reason the leased area includes more acreage than the maximum permitted under applicable law (including the "rule of approximation" authorized in AS 38.05.145 and defined in AS 38.05.965 (18)), this lease is not void and the acreage included in the leased area must be reduced to the permitted maximum. If the state determines that the leased area exceeds the permitted acreage and notifies the lessee in writing of the amount of acreage that must be eliminated, the lessee has 60 days after that notice to surrender one or more legal subdivisions included in the leased area comprising at least the amount of acreage that must be eliminated. Any subdivision surrendered must be located on the perimeter of the leased area as originally described. If a surrender is not filed within 60 days, the state may terminate this lease as to the acreage that must be eliminated by mailing notice of the termination to the lessee describing the subdivision eliminated.

(d) If the State of Alaska's ownership interest in the oil, gas, and associated substances in the leased area is less than an entire and undivided interest, the grant under this lease is effective only as to the state's interest in that oil, gas, and associated substances, and the royalties and rentals provided in this lease must be paid to the state in the proportion that the state's interest bears to the entire undivided fee.

Appendix C: Sample Oil and Gas Lease

(e) The state makes no representations or warranties, express or implied, as to title, or access to, or quiet enjoyment of, the leased area. The state is not liable to the lessee for any deficiency in title to the leased area, nor is the lessee or any successor in interest to the lessee entitled to any refund due to deficiency in title for any rentals, bonuses, or royalties paid under this lease.

2. **RESERVED RIGHTS.** (a) The state, for itself and others, reserves all rights not expressly granted to the lessee by this lease. These reserved rights include, but are not limited to:

(1) the right to explore for oil, gas, and associated substances by geological and geophysical means;

(2) the right to explore for, develop, and remove natural resources other than oil, gas, and associated substances on or from the leased area;

(3) the right to establish or grant easements and rights-of-way for any lawful purpose, including without limitation for shafts and tunnels necessary or appropriate for the working of the leased area or other lands for natural resources other than oil, gas, and associated substances;

(4) the right to dispose of land within the leased area for well sites and well bores of wells drilled from or through the leased area to explore for or produce oil, gas, and associated substances in and from lands not within the leased area; and

(5) the right otherwise to manage and dispose of the surface of the leased area or interests in that land by grant, lease, permit, or otherwise to third parties.

(b) The rights reserved may be exercised by the state, or by any other person or entity acting under authority of the state, in any manner that does not unreasonably interfere with or endanger the lessee's operations under this lease.

3. **TERM.** This lease is issued for an initial primary term of 7 years from the effective date of this lease. The term may be extended as provided in Paragraph 4 below.

4. **EXTENSION.** (a) This lease will be extended automatically if and for so long as oil or gas is produced in paying quantities from the leased area.

(b) This lease will be extended automatically if it is committed to a unit agreement approved or prescribed by the state, and will remain in effect for so long as it remains committed to that unit agreement.

(c) (1) If the drilling of a well whose bottom hole location is in the leased area has commenced as of the date on which the lease otherwise would expire and is continued with reasonable diligence, this lease will continue in effect until 90 days after cessation of that drilling and for so long as oil or gas is produced in paying quantities from the leased area.

(2) If oil or gas in paying quantities is produced from the leased area, and if that production ceases at any time, this lease will not terminate if drilling or reworking operations are commenced on the leased area within six months after cessation of production and are prosecuted with reasonable diligence; if those drilling or reworking operations result in the production of oil or gas, this lease will remain in effect for so long as oil or gas is produced in paying quantities from the leased area.

(d) If there is a well capable of producing oil or gas in paying quantities on the leased area, this lease will not expire because the lessee fails to produce that oil or gas unless the state gives notice to the lessee, allowing a reasonable time, which will not be less than six months after notice, to place the well into production, and the lessee fails to do so. If production is established within the time allowed, this lease is extended only for so long as oil or gas is produced in paying quantities from the leased area.

(e) If the state directs or approves in writing a suspension of all operations on or production from the leased area (except for a suspension necessitated by the lessee's negligence), or if a suspension of all operations on or production from the leased area has been ordered under federal, state, or local law, the lessee's obligation to comply with any express or implied provision of this lease requiring operations or production will be suspended, but not voided, and the lessee shall not be liable for damages for failure to comply with that provision. If the suspension occurs before the expiration of the primary term, the primary term will be extended at the end of the period of the suspension by adding the period of time lost under the primary term because of the suspension. If the suspension occurs during an extension of the primary term under this paragraph, upon removal of that suspension, the lessee will have a reasonable time, which will not be less than six months after notice that the suspension has been removed, to resume operations or production. For the purposes of this subparagraph, any suspension of operations or production specifically required or imposed as a term of sale or by any stipulation made a part of this lease will not be considered a suspension ordered by law.

(f) If the state determines that the lessee has been prevented by force majeure, after efforts made in good faith, from performing any act that would extend the lease beyond the primary term, this lease will not expire during the period of force majeure. If the force majeure occurs before the expiration of the primary term, the primary term will be extended at the end of the period of force majeure by adding the period of time lost under the primary term because of the force majeure. If the force majeure occurs during an extension of the primary term under this paragraph, this lease will not expire during the period of force majeure plus a reasonable time after that period, which will not be less than 60 days, for the lessee to resume operations or production.

(g) Nothing in subparagraphs (e) or (f) suspends the obligation to pay royalties or other production or profit-based payments to the state from operations on the leased area that are not affected by any suspension or force majeure, or suspends the obligation to pay rentals.

5. RENTALS. (a) The lessee shall pay annual rental to the state in accordance with the following rental schedule:

- (1) For the first year, \$1.00 per acre or fraction of an acre;
- (2) For the second year, \$1.50 per acre or fraction of an acre;
- (3) For the third year, \$2.00 per acre or fraction of an acre;
- (4) For the fourth year, \$2.50 per acre or fraction of an acre;
- (5) For the fifth year and following years, \$3.00 per acre or fraction of an acre; provided that

the state may increase the annual rental rate as provided by law upon extension of this lease beyond the primary term.

(b) Annual rental paid in advance is a credit on the royalty or net profit share due under this lease for that year.

(c) The lessee shall pay the annual rental to the State of Alaska (or any depository designated by the state with at least 60 days notice to the lessee) in advance, on or before the annual anniversary date of this lease. The state is not required to give notice that rentals are due by billing the lessee. If the state's (or depository's) office is not open for business on the annual anniversary date of this lease, the time for payment is extended to include the next day on which that office is open for business. If the annual rental is not paid timely, this lease automatically terminates as to both parties at 11:59 p.m., Alaska Standard Time, on the date by which the rental payment was to have been made.

6. RECORDS. The lessee shall keep and have in its possession books and records showing the development and production (including records of development and production expenses) and disposition (including records of sale prices, volumes, and purchasers) of all oil, gas, and associated substances produced from the leased area. The lessee shall permit the State of Alaska or its agents to examine these books and records at all reasonable times. Upon request by the state, the lessee's books and records shall be made available to the state at the state office designated by the state. These books and records of development, production, and disposition must employ methods and techniques that will ensure the most accurate figures reasonably available without requiring the lessee to provide separate tankage or meters for each well. The lessee shall use generally accepted accounting procedures consistently applied.

7. APPORTIONMENT OF ROYALTY FROM APPROVED UNIT. The landowners' royalty share of the unit production allocated to each separately owned tract shall be regarded as royalty to be distributed to and among, or the proceeds of it paid to, the landowners, free and clear of all unit expense and free of any lien for it. Under this provision, the state's royalty share of any unit production allocated to the leased area will be regarded as royalty to be distributed to, or the proceeds of it paid to, the state, free and clear of all unit expenses (and any portion of those expenses incurred away from the unit area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing oil, gas, or associated substances for transportation off the unit area, and free of any lien for them.

8. PAYMENTS. All payments to the State of Alaska under this lease must be made payable to the state in the manner directed by the state, and unless otherwise specified, must be tendered to the state at:

DEPARTMENT OF NATURAL RESOURCES
3601 C STREET, SUITE 1230
ANCHORAGE, ALASKA 99503-5921
ATTENTION: REVENUE UNIT

or to any depository designated by the state with at least 60 days notice to the lessee.

9. PLAN OF OPERATIONS. (a) Except as provided in subparagraph (b) below, before any operations may be undertaken on the leased area, the lessee shall comply with the applicable statutes and regulations in effect on the date the proposed activity is scheduled to commence.

(b) The state will not require a lease plan of operations for lease operations undertaken under an approved unit plan of operations in accordance with 11 AAC.

(c) Before undertaking operations on the leased area, the lessee shall provide for full payment of all damages sustained by the owner of the surface estate as well as by the surface owner's lessees and permittees by reason of entering the land.

(d) An application for approval of a plan of operations must contain sufficient information, based on data reasonably available at the time the plan is submitted for approval, for the state 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 the leased area, including the date operations are proposed to begin and their proposed duration;

(2) projected use requirements directly associated with the proposed operations, including but not limited to the location and design of well sites, material sites, water supplies, solid waste sites, sumps, buildings, roads, utilities, airstrips, and all other facilities and equipment necessary to conduct the proposed operations;

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

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

(f) In approving a lease or unit plan of operations, or an amendment of a plan, the state will require amendments it determines necessary to protect the state's interest, including the environment. The state will not require any amendment that would be inconsistent with the terms of sale under which the lease was obtained or with the terms of the lease itself, or would deprive the lessee of reasonable use of the leasehold interest.

(g) The lessee may, with the approval of the state, amend an approved plan of operations.

(h) Approval by the state of a plan of operations or any modifications of a plan of operations signifies only that the state has no objection to the operations outlined in the plan from the standpoint of the lease administrator and does not relieve the lessee of its obligation to obtain approvals and permits required by other governmental agencies having regulatory authority over those operations.

(i) All of the lessee's operations on the leased area must be in conformance with the approved plan of operations.

(j) Upon completion of operations, the lessee shall inspect the area of operations and submit a report indicating the completion date of operations and stating any noncompliance of which the lessee knows, or should reasonably know, with requirements imposed as a condition of approval of the plan.

10. PLAN OF DEVELOPMENT. (a) Except as provided in subparagraph (d) below, within 12 months after certification of a well capable of producing oil, gas, or associated substances in paying quantities, the lessee shall file two copies of an application for approval by the state of an initial plan of development that must describe the lessee's plans for developing the leased area. No development of the leased area may occur until a plan of development has been approved by the state.

(b) The plan of development must be revised, updated, and submitted to the state for approval annually before or on the anniversary date of the previously approved plan. If no changes from an approved plan are contemplated for the following year, a statement to that effect must be filed for approval in lieu of the required revision and update.

(c) The lessee may, with the approval of the state, subsequently modify an approved plan of development.

(d) If the leased area is included in an approved unit, the lessee will not be required to submit a separate lease plan of development for unit activities.

11. INFORMATION ACQUIRED FROM OPERATIONS. (a) The lessee shall submit to the state all geological, geophysical and engineering data and analyses obtained from the lease within 30 days following the completion of a well. The lessee shall submit to the state data and analyses acquired subsequent to well completion within 30 days following acquisition of that data. The state may waive receipt of operational data from some development, service or injection wells. The state will inform the operator of the waiver prior to well completion. The lessee shall submit the data and analyses to the Division of Oil and Gas, Department of Natural Resources, at the location specified in paragraph 25 of this lease. The data and analyses shall include the following:

(1) a copy of the completion report (AOGCC form 10-407) with an attached well summary, including daily drilling reports, formation tops encountered, a full synopsis of drillstem and formation testing data, an identification of zones of abnormal pressure, oil and gas shows and cored intervals;

(2) latitudinal and longitudinal coordinates for the completed surface and bottom hole locations;

(3) a copy of the permit to drill (AOGCC form 10-401 only, additional documentation not required) and the survey plat of the well location;

(4) a paper copy (no sepia copies) of all final 2-inch open hole and cased hole logs, including measured depth and true-vertical depth versions, specialty logs (such as Schlumberger's cyberlook, formation microscanners and dipmeter logs), composite mud or lithology log and report, measured-while-drilling (MWD) and logged-while-drilling (LWD) logs, velocity and directional surveys;

(5) a digital version of well logs in LAS, LIS or ASCII format on IBM format floppy disks, a digital version of velocity surveys in SEG Y format, a digital version of directional surveys in ASCII format (other formats may be acceptable upon agreement with the Division of Oil and Gas); and

(6) a paper copy of all available well analyses, including geochemical analyses, core analyses (porosity, permeability, capillary pressure, photos, and descriptions), paleontologic and palynologic analyses, thermal maturation analyses, pressure build up analyses, and fluid PVT analyses (an ASCII format digital version of the above information shall also be submitted, if available).

The state may require the lessee to submit additional information in accordance with the applicable statutes and regulations in effect at the time of the completion date of the well.

(b) Any information submitted to the state by the lessee in connection with this lease will be available at all times for use by the state and its agents. The state will keep information confidential as provided in AS 38.05.035(a)(9) and its applicable regulations. In accordance with AS 38.05.035(a)(9)(C), in order for geological, geophysical and engineering information submitted under paragraph 11(a) of this lease to be held confidential, the lessee must request confidentiality at the time the information is submitted. The information must be marked **CONFIDENTIAL**.

12. DIRECTIONAL DRILLING. This lease may be maintained in effect by directional wells whose bottom hole location is on the leased area but that are drilled from locations on other lands not covered by this lease. In those circumstances, drilling will be considered to have commenced on the leased area when actual drilling is commenced on those other lands for the purpose of directionally drilling into the leased area. Production of oil or gas from the leased area through any directional well surfaced on those other lands, or drilling or reworking of that directional well, will be considered production or drilling or reworking operations on the leased area for all purposes of this lease. Nothing contained in this paragraph is intended or will be construed as granting to the lessee any interest, license, easement, or other right in or with respect to those lands in addition to any interest, license, easement, or other right that the lessee may have lawfully acquired from the state or from others.

13. DILIGENCE AND PREVENTION OF WASTE. (a) The lessee shall exercise reasonable diligence in drilling, producing, and operating wells on the leased area unless consent to suspend operations temporarily is granted by the state.

(b) Upon discovery of oil or gas on the leased area in quantities that would appear to a reasonable and prudent operator to be sufficient to recover ordinary costs of drilling, completing, and producing an additional well in the same geologic structure at another location with a reasonable profit to the operator, the lessee must drill those wells as a reasonable and prudent operator would drill, having due regard for the interest of the state as well as the interest of the lessee.

(c) The lessee shall perform all operations under this lease in a good and workmanlike manner in accordance with the methods and practices set out in the approved plan of operations and plan of development, with due regard for the prevention of waste of oil, gas, and associated substances and the entrance of water to the oil and gas-bearing sands or strata to the destruction or injury of those sands or strata, and to the preservation and conservation of the property for future productive operations. The lessee shall carry out at the lessee's expense all orders and requirements of the State of Alaska relative to the prevention of waste and to the preservation of the leased area. If the lessee fails to carry out these orders, the state will have the right, together with any other available legal recourse, to enter the leased area to repair damage or prevent waste at the lessee's expense.

(d) The lessee shall securely plug in an approved manner any well before abandoning it.

14. **OFFSET WELLS.** The lessee shall drill such wells as a reasonable and prudent operator would drill to protect the state from loss by reason of drainage resulting from production on other land. Without limiting the generality of the foregoing sentence, if oil or gas is produced in a well on other land not owned by the State of Alaska or on which the State of Alaska receives a lower rate of royalty than under this lease, and that well is within 500 feet in the case of an oil well or 1,500 feet in the case of a gas well of lands then subject to this lease, and that well produces oil or gas for a period of 30 consecutive days in quantities that would appear to a reasonable and prudent operator to be sufficient to recover ordinary costs of drilling, completing, and producing an additional well in the same geological structure at an offset location with a reasonable profit to the operator, and if, after notice to the lessee and an opportunity to be heard, the state finds that production from that well is draining lands then subject to this lease, the lessee shall within 30 days after written demand by the state begin in good faith and diligently prosecute drilling operations for an offset well on the leased area. In lieu of drilling any well required by this paragraph, the lessee may, with the state's consent, compensate the state in full each month for the estimated loss of royalty through drainage in the amount determined by the state.

15. **UNITIZATION.** (a) The lessee may unite with others, jointly or separately, in collectively adopting and operating under a cooperative or unit agreement for the exploration, development, or operation of the pool, field, or like area or part of the pool, field, or like area that includes or underlies the leased area or any part of the leased area whenever the state determines and certifies that the cooperative or unit agreement is in the public interest.

(b) The lessee agrees, within six months after demand by the state, to subscribe to a reasonable cooperative or unit agreement that will adequately protect all parties in interest, including the state. The state reserves the right to prescribe such an agreement.

(c) With the consent of the lessee, and if the leased area is committed to a unit agreement approved by the state, the state may establish, alter, change, or revoke drilling, producing, and royalty requirements of this lease as the state determines necessary or proper to secure the proper protection of the public interest.

(d) Except as otherwise provided in this subparagraph, where only a portion of the leased area is committed to a unit agreement approved or prescribed by the state, that commitment constitutes a severance of this lease as to the unitized and nonunitized portions of the leased area. The portion of the leased area not committed to the unit will be treated as a separate and distinct lease having the same effective date and term as this lease and may be maintained only in accordance with the terms and conditions of this lease, statutes, and regulations. Any portion of the leased area not committed to the unit agreement will not be affected by the unitization or pooling of any other portion of the leased area, by operations in the unit, or by suspension approved or ordered for the unit. If the leased area has a well certified as capable of production in paying quantities on it before commitment to a unit agreement, this lease will not be severed. If any portion of this lease is included in a participating area formed under a unit agreement, the entire leased area will remain committed to the unit and this lease will not be severed.

16. **INSPECTION.** The lessee shall keep open at all reasonable times, for inspection by any duly authorized representative of the State of Alaska, the leased area, all wells, improvements, machinery, and fixtures on the leased area, and all reports and records relative to operations and surveys or investigations on or with regard to the leased area or under this lease. Upon request, the lessee shall furnish the State of Alaska with copies of and extracts from any such reports and records.

17. **SUSPENSION.** The state may from time to time direct or approve in writing suspension of production or other operations under this lease.

18. **ASSIGNMENT, PARTITION, AND CONVERSION.** This lease, or an interest in this lease, may, with the approval of the state, be assigned, subleased, or otherwise transferred to any person or persons qualified to hold a lease. No assignment, sublease, or other transfer of an interest in this lease, including assignments of working or royalty interests and operating agreements and subleases, will be binding upon the state unless approved by the state. The lessee shall remain liable for all obligations under this lease accruing prior to the approval by the state of any assignment, sublease, or other transfer of an interest in this lease. All provisions of this lease will extend to and be binding upon the heirs, administrators, successors, and assigns of the state and the lessee. Applications for approval of an assignment, sublease, or other transfer must comply with all applicable regulations and must be filed within 90 days after the date of final execution of the instrument of transfer. The state will approve a transfer of an undivided interest in this lease unless the transfer would adversely affect the interests of Alaska or the application does not comply with applicable regulations. The state will disapprove a transfer of a divided interest in this lease if the transfer covers only a portion of the lease or a separate and distinct zone or geological horizon unless the lessee demonstrates that the proposed transfer of a divided interest is reasonably necessary to accomplish exploration or development of the lease, the lease is committed to an approved unit agreement, the lease is allocated production within an approved participating area, or the lease has a well certified as capable of production in paying quantities. The state will make a written finding stating the reasons for disapproval of a transfer of a divided interest. Where an assignment, sublease, or other transfer is made of all or a part of

the lessee's interest in a portion of the leased area, this lease may, at the option of the state or upon request of the transferee and with the approval of the state, be severed, and a separate and distinct lease will be issued to the transferee having the same effective date and terms as this lease.

19. **SURRENDER.** The lessee at any time may file with the state a written surrender of all rights under this lease or any portion of the leased area comprising one or more legal subdivisions or, with the consent of the state, any separate and distinct zone or geological horizon underlying the leased area or one or more legal subdivisions of the leased area. That surrender will be effective as of the date of filing, subject to the continued obligations of the lessee and its surety to make payment of all accrued royalties and to place all wells and surface facilities on the surrendered land or in the surrendered zones or horizons in condition satisfactory to the state for suspension or abandonment. After that, the lessee will be released from all obligations under this lease with respect to the surrendered lands, zones, or horizons.

20. **DEFAULT AND TERMINATION; CANCELLATION.** (a) The failure of the lessee to perform timely its obligations under this lease, or the failure of the lessee otherwise to abide by all express and implied provisions of this lease, is a default of the lessee's obligations under this lease. Whenever the lessee fails to comply with any of the provisions of this lease (other than a provision which, by its terms, provides for automatic termination), and fails within 60 days after written notice of that default to begin and diligently prosecute operations to remedy that default, the state may terminate this lease if at the time of termination there is no well on the leased area capable of producing oil or gas in paying quantities. If there is a well on the leased area capable of producing oil or gas in paying quantities, this lease may be terminated by an appropriate judicial proceeding. In the event of any termination under this subparagraph, the lessee shall have the right to retain under this lease any and all drilling or producing wells for which no default exists, together with a parcel of land surrounding each well or wells and rights-of-way through the leased area that are reasonably necessary to enable the lessee to drill, operate, and transport oil or gas from the retained well or wells.

(b) The state may cancel this lease at any time if the state determines, after the lessee has been given notice and a reasonable opportunity to be heard, that:

(1) continued operations pursuant to this lease probably will cause serious harm or damage to biological resources, to property, to mineral resources, or to the environment (including the human environment);

(2) the threat of harm or damage will not disappear or decrease to an acceptable extent within a reasonable period of time; and

(3) the advantages of cancellation outweigh the advantages of continuing this lease in effect. Any cancellation under this subparagraph will not occur unless and until operations under this lease have been under suspension or temporary prohibition by the state, with due extension of the term of this lease, continuously for a period of five years or for a lesser period upon request of the lessee.

(c) Any cancellation under subparagraph (b) will entitle the lessee to receive compensation as the lessee demonstrates to the state is equal to the lesser of:

(1) the value of the cancelled rights as of the date of cancellation, with due consideration being given to both anticipated revenues from this lease and anticipated costs, including costs of compliance with all applicable regulations and stipulations, liability for clean-up costs or damages, or both, in the case of an oil spill, and all other costs reasonably anticipated under this lease; or

(2) the excess, if any, over the lessee's revenues from this lease (plus interest on the excess from the date of receipt to date of reimbursement) of all consideration paid for this lease and all direct expenditures made by the lessee after the effective date of this lease and in connection with exploration or development, or both, under this lease, plus interest on that consideration and those expenditures from the date of payment to the date of reimbursement.

21. **RIGHTS UPON TERMINATION.** Upon the expiration or earlier termination of this lease as to all or any portion of the leased area, the lessee will be directed in writing by the state and will have the right at any time within a period of one year after the termination, or any extension of that period as may be granted by the state, to remove from the leased area or portion of the leased area all machinery, equipment, tools, and materials. Upon the expiration of that period or extension of that period and at the option of the state, any machinery, equipment, tools, and materials that the lessee has not removed from the leased area or portion of the leased area become the property of the state or may be removed by the state at the lessee's expense. At the option of the state, all improvements such as roads, pads, and wells must either be abandoned and the sites rehabilitated by the lessee to the satisfaction of the state, or be left intact and the lessee absolved of all further responsibility as to their maintenance, repair, and eventual abandonment and rehabilitation. Subject to the above conditions, the lessee shall deliver up the leased area or those portions of the leased area in good condition.

22. **DAMAGES AND INDEMNIFICATION.** (a) No rights under the AS 38.05.125 reservation may be exercised by the lessee until the lessee has provided to pay the owner of the land, his lessees and permittees, upon which the AS 38.05.125 reserved rights are sought to be exercised, full payment for all damage sustained by the owner by reason of

entering the land. If the owner for any reason does not settle the damages, the lessee may enter the land after posting a surety bond determined by the state, after notice and an opportunity to be heard, to be sufficient as to form, amount, and security to secure to the owner, his lessees and permittees, payment for damages, and may institute legal proceedings in a court of competent jurisdiction where the land is located to determine the damages which the owner of the land may suffer. The lessee agrees to pay for any damages that may become payable under AS 38.05.130 and to indemnify the state and hold it harmless from and against any claims, demands, liabilities, and expenses arising from or in connection with such damages. The furnishing of a bond in compliance with this paragraph will be regarded by the state as sufficient provision for the payment of all damages that may become payable under AS 38.05.130 by virtue of this lease.

(b) The lessee shall indemnify the state for, and hold it harmless from, any claim, including claims for loss or damage to property or injury to any person caused by or resulting from any act or omission committed under this lease by or on behalf of the lessee. The lessee is not responsible to the state under this subparagraph for any loss, damage, or injury caused by or resulting from the sole negligence of the state.

(c) The lessee expressly waives any defense to an action for breach of a provision of this lease or for damages resulting from an oil spill or other harm to the environment that is based on an act or omission committed by an independent contractor in the lessee's employ. The lessee expressly agrees to assume responsibility for all actions of its independent contractors.

23. BONDS. (a) If required by the state, the lessee shall furnish a bond prior to the issuance of this lease in an amount equal to at least \$5 per acre or fraction of an acre contained in the leased area, but no less than \$10,000, and must maintain that bond as long as required by the state.

(b) The lessee may, in lieu of the bond required under (a) above, furnish and maintain a statewide bond in accordance with applicable regulations.

(c) The state may, after notice to the lessee and a reasonable opportunity to be heard, require a bond in a reasonable amount greater than the amount specified in (a) above where a greater amount is justified by the nature of the surface and its uses and the degree of risk involved in the types of operations being or to be carried out under this lease. A statewide bond will not satisfy any requirement of a bond imposed under this subparagraph, but will be considered by the state in determining the need for and the amount of any additional bond under this subparagraph.

(d) If the leased area is committed in whole or in part to a cooperative or unit agreement approved or prescribed by the state, and the unit operator furnishes a statewide bond, the lessee need not maintain any bond with respect to the portion of the leased area committed to the cooperative or unit agreement.

24. AUTHORIZED REPRESENTATIVES. The Director of the Division of Oil and Gas, Department of Natural Resources, State of Alaska, and the person executing this lease on behalf of the lessee shall be authorized representatives for their respective principals for the purposes of administering this lease. The state or the lessee may change the designation of its authorized representative or the address to which notices to that representative are to be sent by a notice given in accordance with Paragraph 25 below. Where activities pursuant to a plan of operations are underway, the lessee shall also designate, pursuant to a notice under Paragraph 25 below, by name, job title, and address, an agent who will be present in the state during all lease activities.

25. NOTICES; PROTEST. (a) Any notices required or permitted under this lease must be by electronic media producing a permanent record or in writing and must be given personally or by registered or certified mail, return receipt requested, addressed as follows:

TO THE STATE:

DIRECTOR, DIVISION OF OIL AND GAS
DEPARTMENT OF NATURAL RESOURCES
3601 C STREET, SUITE 1380
ANCHORAGE, ALASKA 99503-5948

TO THE LESSEE:

(b) Any notice given under this paragraph will be effective when delivered to the above authorized representative.

(c) A lessee who wishes to protest the amount of money due the state under the lease or any action of the state regarding a provision of this lease must file a written protest with the Division of Oil and Gas within 30 days after

the mailing date of the state's notice or bill. A lessee who fails to file a protest within the required time waives any further right to protest. The state will establish the administrative appeal procedure to be followed and will inform the lessee of the procedure no later than 30 days after the filing of the written protest.

26. **STATUTES AND REGULATIONS.** This lease is subject to all applicable state and federal statutes and regulations in effect on the effective date of this lease, and insofar as is constitutionally permissible, to all statutes and regulations placed in effect after the effective date of this lease. A reference to a statute or regulation in this lease includes any change in that statute or regulation whether by amendment, repeal and replacement, or other means. This lease does not limit the power of the State of Alaska or the United States of America to enact and enforce legislation or to promulgate and enforce regulations affecting, directly or indirectly, the activities of the lessee or its agents in connection with this lease or the value of the interest held under this lease. In case of conflicting provisions, statutes and regulations take precedence over this lease.

27. **INTERPRETATION.** This lease is to be interpreted in accordance with the rules applicable to the interpretation of contracts made in the State of Alaska. The paragraph headings are not part of this lease and are inserted only for convenience. The state and the lessee expressly agree that the law of the State of Alaska will apply in any judicial proceeding affecting this lease.

28. **INTEREST IN REAL PROPERTY.** It is the intention of the parties that the rights granted to the lessee by this lease constitute an interest in real property in the leased area.

29. **WAIVER OF CONDITIONS.** The state reserves the right to waive any breach of a provision of this lease, but any such waiver extends only to the particular breach so waived and does not limit the rights of the state with respect to any future breach; nor will the waiver of a particular breach prevent cancellation of this lease for any other cause or for the same cause occurring at another time. Notwithstanding the foregoing, the state will not be deemed to have waived a provision of this lease unless it does so in writing.

30. **SEVERABILITY.** If it is finally determined in any judicial proceeding that any provision of this lease is invalid, the state and the lessee may jointly agree by a written amendment to this lease that, in consideration of the provisions in that written amendment, the invalid portion will be treated as severed from this lease and that the remainder of this lease, as amended, will remain in effect.

31. **LOCAL HIRE.** The lessee is encouraged to hire and employ local and Alaska residents and companies, to the extent they are available and qualified, for work performed on the leased area. Lessees shall submit, with the plans of operations, a proposal detailing the means by which the lessee will comply with this measure. The lessee is encouraged, in formulating this proposal, to coordinate with employment services offered by the State of Alaska and local communities and to recruit employees from local communities.

32. **CONDITIONAL LEASE.** If all or a part of the leased area is land that has been selected by the state under laws of the United States granting lands to the state, but the land has not been patented to the state by the United States, then this lease is a conditional lease as provided by law until the patent becomes effective. If for any reason the selection is not finally approved, or the patent does not become effective, any rental, royalty, or other production or profit-based payments made to the state under this lease will not be refunded.

33. **NONDISCRIMINATION.** The lessee and the lessee's contractors and subcontractors may not discriminate against any employee or applicant because of race, religion, marital status, change in marital status, pregnancy, parenthood, physical handicap, color, sex, age, or national origin as set out in AS 18.80.220. The lessee and its contractors and subcontractors must, on beginning any operations under this lease, post in a conspicuous place notices setting out this nondiscrimination provision.

34. **DEFINITIONS.** All words and phrases used in this lease are to be interpreted where possible in the manner required in respect to the interpretation of statutes by AS 01.10.040. However, the following words have the following meanings unless the context unavoidably requires otherwise:

(1) "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;

(2) "gas" means all natural gas (except helium gas) and all other hydrocarbons produced that are not defined in this lease as oil;

(3) "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 lease as oil or gas;

(4) "drilling" means the act of boring a hole to reach a proposed bottom hole location through which oil or gas may be produced if encountered in paying quantities, and includes re-drilling, sidetracking, deepening, or other means necessary to reach the proposed bottom hole location, testing, logging, plugging, and other operations necessary and incidental to the actual boring of the hole;

(5) "reworking operations" means all operations designed to secure, restore, or improve production through some use of a hole previously drilled, including, but not limited to, mechanical or chemical treatment of any horizon, plugging back to test higher strata, etc.;

(6) "paying quantities" means quantities sufficient to yield a return in excess of operating costs, even if drilling and equipment costs may never be repaid and the undertaking considered as a whole may ultimately result in a loss; quantities are insufficient to yield a return in excess of operating costs unless those quantities, not considering the costs of transportation and marketing, will produce sufficient revenue to induce a prudent operator to produce those quantities; and

(7) "force majeure" means war, riots, acts of God, unusually severe weather, or any other cause beyond the lessee's reasonable ability to foresee or control and includes operational failure of existing transportation facilities and delays caused by judicial decisions or lack of them.

35. **ROYALTY ON PRODUCTION.** Except for oil, gas, and associated substances used on the leased area for development and production or unavoidably lost, the lessee shall pay to the state as a royalty 16.66667 percent in amount or value of the oil, gas, and associated substances saved, removed, or sold from the leased area and of the gas from the leased area used on the leased area for extraction of natural gasoline or other products.

36. **VALUE.** (a) For the purposes of computing royalties due under this lease, the value of royalty oil, gas, or associated substances shall not be less than the highest of:

(1) the field price received by the lessee for the oil, gas, or associated substances;

(2) the volume-weighted average of the three highest field prices received by other producers in the same field or area for oil of like grade and gravity, gas of like kind and quality, or associated substances of like kind and quality at the time the oil, gas, or associated substances are sold or removed from the leased or unit area or the gas is delivered to an extraction plant if that plant is located on the leased or unit area; if there are less than three prices reported by other producers, the volume-weighted average will be calculated using the lesser number of prices received by other producers in the field or area;

(3) the lessee's posted price in the field or area for the oil, gas, or associated substances; or

(4) the volume-weighted average of the three highest posted prices in the same field or area of the other producers in the same field or area for oil of like grade and gravity, gas of like kind and quality, or associated substances of like kind and quality at the time the oil, gas, or associated substances are sold or removed from the leased or unit area or the gas is delivered to an extraction plant if that plant is located on the leased or unit area; if there are less than three prices posted by other producers, the volume-weighted average will be calculated using the lesser number of prices posted by other producers in the field or area.

(b) If oil, gas, or associated substances are sold away from the leased or unit area, the term "field price" in subparagraph (a) above will be the cash value of all consideration received by the lessee or other producer from the purchaser of the oil, gas, or associated substances, less the reasonable costs of transportation away from the leased or unit area to the point of sale. The "reasonable costs of transportation" are as defined in 11 AAC 83.228 and 11 AAC 83.229 as those regulations exist on the effective date of this lease.

(c) In the event the lessee does not sell in an arm's-length transaction the oil, gas, or associated substances, the term "field price" in subparagraphs (a) and (b) above will mean the price the lessee would expect to receive for the oil, gas, or associated substances if the lessee did sell the oil, gas, or associated substances in an arm's-length transaction, minus reasonable costs of transportation away from the leased or unit area to the point of sale or other disposition. The lessee must determine this price in a consistent and logical manner using information available to the lessee and report that price to the state.

(d) The state may establish minimum values for the purposes of computing royalties on oil, gas, or associated substances obtained from this lease, with consideration being given to the price actually received by the lessee, to the price or prices paid in the same field or area for production of like quality, to posted prices, to prices received by the lessee and/or other producers from sales occurring away from the leased area, and/or to other relevant matters. In establishing minimum values, the state may use, but is not limited to, the methodology for determining "prevailing value" as defined in 11 AAC 83.227. Each minimum value determination will be made only after the lessee has been given notice and a reasonable opportunity to be heard. Under this provision, it is expressly agreed that the minimum value of royalty oil, gas, or associated substances under this lease may not necessarily equal, and may exceed, the price of the oil, gas, or associated substances.

37. **ROYALTY IN VALUE.** Except to the extent that the state elects to receive all or a portion of its royalty in kind as provided in Paragraph 38 below, the lessee shall pay to the state that value of all royalty oil, gas, and associated substances as determined under Paragraph 36 above. Royalty paid in value will be free and clear of all lease expenses (and any portion of those expenses that is incurred away from the leased area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing the oil, gas, or associated substances for transportation off the leased area. All royalty that may become payable in money to the State of Alaska must be paid on or before the last federal banking day of the calendar month following the month in which the oil, gas, or associated substances are produced. The amount of all royalty in value payments which are not paid when due under this lease or the amount which is subsequently determined to be due to the state or the lessee as the result of a redetermination will bear interest from the last federal banking day of the calendar month following the month in which the oil, gas, or associated substances were produced, until the obligation is paid in full. Interest shall accrue at the rate provided in AS+38.05.135(d) or as may later be amended. Royalty payments must be accompanied by such information relating to valuation of royalty as the state may require which may include, but is not limited to, run tickets, evidence of sales, shipments, and amounts of gross oil, gas, and associated substances produced.

38. **ROYALTY IN KIND.** (a) At the state's option, which may be exercised from time to time upon not less than 90 days' notice to the lessee, the lessee shall deliver all or a portion of the state's royalty oil, gas, or associated substances produced from the leased area in kind. Delivery will be on the leased area, unit area, or at a place mutually agreed to by the state and the lessee, and must be delivered to the State of Alaska or to any individual, firm, or corporation designated by the state.

(b) Royalty oil, gas, or associated substances delivered in kind must be delivered in good and merchantable condition, of pipeline quality, and free and clear of all lease expenses (and any portion of those expenses incurred away from the leased area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing the oil, gas, or associated substances for transportation off the leased area.

(c) After having given notice of its intention to take, or after having taken its royalty oil, gas, or associated substances in kind, the state, at its option and upon 90 days' notice to the lessee, may elect to receive a different portion or none of its royalty in kind. If, under federal regulations, the taking of royalty oil, gas, or associated substances in value by the state creates a supplier-purchaser relationship, the lessee hereby waives its right to continue to receive royalty oil, gas, or associated substances under that relationship, and further agrees that it will require any purchasers of the royalty oil, gas, or associated substances likewise to waive any supplier-purchaser rights.

(d) The lessee shall furnish storage for royalty oil, gas, and associated substances produced from the leased or unit area to the same extent that the lessee provides storage for the lessee's share of oil, gas, and associated substances. The lessee shall not be liable for the loss or destruction of stored royalty oil, gas and associated substances from causes beyond the lessee's ability to control.

(e) If a state royalty purchaser refuses or for any reason fails to take delivery of oil, gas, or associated substances, or in an emergency, and with as much notice to the lessee as is practical or reasonable under the circumstances, the state may elect without penalty to underlift for up to six months all or a portion of the state's royalty on oil, gas, or associated substances produced from the leased or unit area and taken in kind. The state's right to underlift is limited to the portion of royalty oil, gas, or associated substances that the royalty purchaser refused or failed to take delivery of, or the portion necessary to meet the emergency condition. Underlifted oil, gas, or associated substances may be recovered by the state at a daily rate not to exceed 10 percent of its royalty interest share of daily production at the time of the underlift recovery.

39. **REDUCTION OF ROYALTY.** Lessee may request a reduction of royalty in accordance with the applicable statutes and regulations in effect on the date of application for the reduction.

40. **EFFECTIVE DATE.** This lease takes effect on

BY SIGNING THIS LEASE, the state as lessor and the lessee agree to be bound by its provisions.

STATE OF ALASKA

By: _____
Kenneth A. Boyd
Director, Division of Oil and Gas

Appendix C: Sample Oil and Gas Lease

STATE OF ALASKA)
) ss.
Third Judicial District)

On _____, before me appeared Kenneth A. Boyd of the Division of Oil and Gas of the State of Alaska, Department of Natural Resources, and who executed this lease and acknowledged voluntarily signing it on behalf of the State of Alaska as lessor.

Notary public in and for the State of Alaska
My commission expires _____

LESSEE: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LESSEE'S SIGNATURE HERE.

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
and
ARCTIC SLOPE REGIONAL CORPORATION

Competitive Oil and Gas Lease

ADL No.

THIS LEASE is entered into _____, between the State of Alaska ("the State"), acting for itself and on behalf of Arctic Slope Regional Corporation, an Alaska corporation ("ASRC"), as holder of executive rights with respect to the interests of ASRC in oil, gas, and associated substances pursuant to the 1991 SETTLEMENT AGREEMENT BETWEEN ARCTIC SLOPE REGIONAL CORPORATION AND THE STATE OF ALASKA ("Settlement Agreement") which was approved by the Alaska Legislature in chapter 41, SLA 1992; and

"the lessee," whether one or more, whose sole address for purposes of notification is under Paragraph 25. (Unless otherwise specifically stated, all references hereinafter in this lease to "lessors" shall refer to both the State and ASRC, collectively, except that the State or ASRC will sometimes be referred to singularly as "lessor".)

SETTLEMENT AGREEMENT. The State discharges its duty as executive with respect to the interests of ASRC by entering into this lease for itself and for the interests of ASRC in oil, gas, and associated substances in or under the leased area. The State and ASRC will each separately administer this lease with respect to its own undivided interests. All payments due under this lease must be made to the owner of the respective undivided interest as set out in Paragraph 8.

As provided in the Settlement Agreement, the applicable terms of the Settlement Agreement are incorporated by reference in this lease. The lessee agrees that ASRC shall have the right to enforce all the terms of this lease (whether express or implied) directly on its own behalf and with respect only to ASRC's undivided interest in the oil, gas, and associated substances in and under the leased area, including any provision allowing termination of this lease as to the interest of ASRC for a breach of its terms, whether or not the State elects to do so with respect to the undivided interests of the State in the oil, gas, and associated substances in the leased area or portion of the leased area involved. Conversely, the lessee agrees that the State shall have the right to enforce all the terms of this lease (whether express or implied) directly on its own behalf and with respect only to the State's undivided interests in the oil, gas, and associated substances in and under the leased area, including any provision allowing termination of this lease as to the interests of the State for a breach of its terms, whether or not ASRC elects to do so with respect to the undivided interests of ASRC in the oil, gas, and associated substances in the leased area or portion of the leased area involved. In any instance when any action, notice, or decision is provided or permitted to be taken, given, or made by "lessors" under any term or provision of this lease, then, unless otherwise specifically provided in this lease, each of ASRC and the State shall have the independent right, acting solely on its own behalf and with respect only to its undivided interests in the oil, gas, and associated substances in and under the leased area to take, give or make such action, notice or decision, without regard to whether the other lessor takes, gives, or makes a like or different action, notice or decision or omits to do so. Except for the action of the State acting as executive under and pursuant to the Settlement Agreement in entering into and granting this lease on behalf of ASRC, and except as otherwise elsewhere specifically provided in this lease, no action, notice, or decision of ASRC, alone, or of the State, alone, in connection with this lease or the leased area shall be effective with respect to or binding upon the other lessor or as to that other lessor's interests in the oil, gas, and associated substances in and under the leased area.

IN CONSIDERATION of the cash payment made by the lessee to lessors, which payment includes the first year's rental and any required cash bonus, and subject to the provisions of this lease, including applicable stipulation(s) and mitigating measures attached to this lease and by this reference incorporated in this lease, the State, acting for itself and on behalf of ASRC as holder of executive rights with respect to the interests of ASRC in oil, gas, and associated substances in or under the leased area pursuant to the Settlement Agreement, and the lessee agree as follows:

1. GRANT. (a) Subject to the provisions in this lease, the State, acting for itself and on behalf of ASRC as holder of executive rights with respect to the interests of ASRC in oil, gas, and associated substances in or under the leased area

incident to submitting a bid or offer for this lease and which is refundable to lessee in the event of rejection of that bid or offer may be paid by lessee to the State, and ASRC will look to the State for accounting for the applicable ASRC percentage of that bid deposit in the event of acceptance of that bid or offer. Likewise, Lessee agrees and covenants, for itself and its successors and assigns, to pay or deliver directly to the State the applicable State percentage in amount, or in kind (if applicable under Section 38 of this lease), of all bid deposits, bonuses, annual rentals, royalties, net profits and other consideration or thing of value payable by lessee to the lessors for or under this lease, determined and calculated separately with respect to the respective portions of the leased area within each of the separate sections of land described above in which the leased area is situated.

9. **PLAN OF OPERATIONS.** Where required by law or regulation, no lease operations may be undertaken on the leased area until a plan of operations has been approved by the State pursuant to 11 AAC 83.158, 11 AAC 83.343, or other applicable regulations. At the time a proposed plan of operations is submitted for review and approval by the State, five copies must also be provided to ASRC solely for its information.

10. **PLAN OF DEVELOPMENT.** (a) Except as provided in subparagraph (d) below, within 12 months after certification of a well capable of producing oil, gas, or associated substances in paying quantities, the lessee shall file two copies of an application for approval by each lessor of an initial plan of development that must describe the lessee's plans for developing the leased area. No development of the leased area may occur until a plan of development has been approved by each of the State and ASRC with respect to its undivided interest.

(b) The plan of development must be revised, updated, and submitted to the lessors for approval annually before or on the anniversary date of the previously approved plan. If no changes from an approved plan are contemplated for the following year, a statement to that effect must be filed for approval by each of the State and ASRC with respect to its undivided interest in lieu of the required revision and update.

(c) The lessee may, with the approval of each of the State and ASRC with respect to its undivided interest, subsequently modify an approved plan of development.

(d) If the leased area is included in an approved unit, the lessee will not be required to submit a separate lease plan of development for unit activities.

(e) Neither the State nor ASRC will unreasonably withhold any approval required by this section.

11. **LOGS AND OTHER RECORDS OF OPERATIONS.** (a) The lessee shall file with the State and ASRC copies of all logs, all raw and all processed geological and geophysical data, a description of all tests run for each well drilled on the leased area, and a plat showing the exact location of each well. This information shall be provided the State and ASRC within 30 days after each well or survey has been completed, suspended, or abandoned.

(b) After conducting seismic exploration on the leased area, the lessee shall provide the same notification and review privileges to ASRC as it is required to accord the State under 11 AAC 96.210 or subsequent regulations.

(c) Any information filed by the lessee in connection with this lease will be available at all times for the use of each of the State and ASRC and their agents except that the State will keep information confidential as provided in AS 38.05.035(a)(9), AS 31.05.035, and applicable regulations, and ASRC will keep information confidential in the same manner as the State.

12. **DIRECTIONAL DRILLING.** This lease may be maintained in effect by directional wells whose bottom hole location is on the leased area but that are drilled from locations on other lands not covered by this lease. In those circumstances, drilling will be considered to have commenced on the leased area when actual drilling is commenced on those other lands for the purpose of directionally drilling into the leased area. Production of oil or gas from the leased area through any directional well surfaced on those other lands, or drilling or reworking of that directional well, will be considered production or drilling or reworking operations on the leased area for all purposes of this lease. Nothing contained in this paragraph is intended or will be construed as granting to the lessee any interest, license, easement, or other right in or with respect to those lands in addition to any interest, license, easement, or other right that the lessee may have lawfully acquired from the lessors or from others.

13. **DILIGENCE AND PREVENTION OF WASTE.** (a) The lessee shall exercise reasonable diligence in drilling, producing, and operating wells on the leased area unless consent to suspend operations temporarily is granted by lessors.

(b) Upon discovery of oil or gas on the leased area in quantities that would appear to a reasonable and prudent operator to be sufficient to recover ordinary costs of drilling, completing, and producing an additional well in the same geologic structure at another location with a reasonable profit to the operator, the lessee must drill those wells as a reasonable and prudent operator would drill, having due regard for the interest of the lessors as well as the interest of the lessee.

(c) The lessee shall perform all operations under this lease with due care and in a good and workmanlike manner in accordance with modern methods and practices set out in the approved plan of operations and plan of development, with due regard for the prevention of waste of oil, gas, and associated substances and the entrance of water to the oil and gas-bearing sands or strata to the destruction or injury of those sands or strata, and to the preservation and conservation of the property for future productive operations. The lessee shall carry out at the lessee's expense all orders and requirements of the State relative to the prevention of waste and to the preservation of the leased area. If the lessee fails

to carry out these orders, a lessor will have the right, together with any other available legal recourse, to enter the leased area to repair damage or prevent waste at the lessee's expense.

(d) The lessee shall securely plug in an approved manner any well before abandoning it.

(e) The lessee shall use modern geological and geophysical techniques in exploration and development of the leased area.

(f) The lessee shall cause any identified commercial reservoirs of oil, gas, or associated substances within the leased area to be reasonably developed and produced.

14. **OFFSET WELLS.** The lessee shall drill such wells as a reasonable and prudent operator would drill to protect the lessors from loss by reason of drainage resulting from production on other land. Without limiting the generality of the foregoing sentence, if oil or gas is produced in a well on other land in which the State or ASRC owns a lesser percentage share of the oil, gas and associated substances, or on which the State or ASRC receives a lower royalty than that covered by this lease, and that well is within 500 feet in the case of an oil well or 1,500 feet in the case of a gas well of lands then subject to this lease, and that well produces oil or gas for a period of 30 consecutive days in quantities that would appear to a reasonable and prudent operator to be sufficient to recover ordinary costs of drilling, completing, and producing an additional well in the same geological structure at an offset location with a reasonable profit to the operator, and if, after notice to the lessee and an opportunity to be heard, either the State or ASRC finds that production from that well is draining lands then subject to this lease, the lessee shall within 30 days after written demand by either the State or ASRC begin in good faith and diligently prosecute drilling operations for an offset well on the leased area. In lieu of drilling any well required by this paragraph, the lessee may, with the consent of both the State and ASRC, or, if only one of lessors is suffering loss of royalty through drainage, with the consent of that one lessor, compensate each of lessors, or if only one of the lessors is suffering loss of royalty through drainage that one of the lessors, in full each month for the estimated loss of royalty through drainage in the amount determined by each of the lessors, or, if applicable, by the one lessor who is suffering loss of royalty through drainage.

15. **UNITIZATION.** (a) As to the undivided interests owned by the State in the oil, gas, or associated substances in the leased area, the lessee may unite with others, jointly or separately, in collectively adopting and operating under a cooperative or unit agreement for the exploration, development, or operation of the pool, field, or like area or part of the pool, field, or like area that includes or underlies the leased area or any part of the leased area whenever the State determines and certifies that the cooperative or unit agreement is in the public interest. Likewise, as to the undivided interests owned by ASRC in the oil, gas, or associated substances in the leased area, the lessee may unite with others, jointly or separately, in collectively adopting and operating under a cooperative or unit agreement for the exploration, development, or operation of the pool, field, or like area or part of the pool, field, or like area that includes or underlies the leased area or any part of the leased area, with the express prior written approval of ASRC of such a cooperative or unit agreement and upon such terms and conditions as shall be mutually agreed by lessee and ASRC.

(b) The State's approval of a cooperative or unit agreement or of any change in any such agreement shall be effective with respect only to the undivided interests owned by the State in the oil, gas, or associated substances in the leased area or part of the leased area included in or affected by that agreement. Likewise, ASRC's approval of a cooperative or unit agreement or of any change in any such agreement shall be effective with respect only to the undivided interests owned by ASRC in the oil, gas, or associated substances in the leased area or part of the leased area included in or affected by that agreement. If the State's approval of a cooperative or unit agreement including or affecting the undivided interests owned by the State in oil, gas or associated substances in all or part of the leased area is conditioned upon such agreement being effective with respect to the undivided interests in oil, gas, or associated substances owned by ASRC in such area, the lessee must obtain written approval by ASRC of a proposed cooperative or unit agreement before submitting an application to the State for approval of such cooperative or unit agreement. ASRC may condition its approval of any such proposed cooperative or unit agreement in such manner as ASRC deems necessary to protect its interests, including, without limitation, requiring its further consent to any changes in the application for State approval or in the proposed cooperative or unit agreement.

(c) The lessee agrees, within six months after demand by both the State and ASRC, to subscribe to a reasonable cooperative or unit agreement approved by both lessors that will adequately protect all parties in interest, including the lessors. Further, the lessors, acting jointly reserve the right to prescribe such an agreement upon terms and conditions approved by both lessors.

(d) The lessee also agrees, within six months after demand by the State alone, to subscribe to a reasonable cooperative or unit agreement approved by the State and including and affecting the undivided interests owned by the State in oil, gas or associated substances in the leased area or part thereof that will adequately protect all parties in interest, including the State. Further, the State reserves the right to prescribe such an agreement including and affecting the undivided interests owned by the State in oil, gas, and associated substances upon terms and conditions approved by the State. However, no cooperative or unit agreement required or prescribed by the State alone pursuant to this subparagraph (d) shall be effective with respect to the undivided interests owned by ASRC in oil, gas or associated substances in the leased area without the express agreement and approval of such agreement by ASRC.

(e) Except as otherwise provided in this subparagraph, where only a portion of the leased area is committed to a unit agreement approved by a lessor, that commitment constitutes a severance of this lease as to the undivided interests owned by that lessor in the unitized and nonunitized portions of the leased area. The portion of the leased area not committed to the unit will be treated as a separate and distinct lease covering the undivided interest in oil, gas, and

associated substances owned by that lessor and having the same effective date and term as this lease and may be maintained only in accordance with the terms and conditions of this lease and any applicable statutes and regulations. Any portion of the leased area not committed to the unit agreement will not be affected by the unitization or pooling of any other portion of the leased area, by operations in the unit, or by suspension approved or ordered for the unit. If the leased area has a well certified as capable of production in paying quantities on it before commitment to a unit agreement, this lease will not be severed pursuant to the subparagraph, and if any portion of the leased area is included in a participating area formed under a unit agreement approved by a lessor, the undivided interests in oil, gas, or associated substances owned by that lessor in the entire leased area will remain committed to the unit and this lease will not be severed as to the undivided interests in oil, gas, and associated substances in the leased area owned by that lessor.

(f) Neither the State nor ASRC will unreasonably withhold any approval required by this section.

16. **INSPECTION.** The lessee shall keep open at all reasonable times, for inspection and audit by any duly authorized representative of the State or ASRC, the leased area, all wells, improvements, machinery, and fixtures on the leased area, and all reports and records relative to operations and surveys or investigations on or with regard to the leased area or under this lease. Upon request, the lessee shall furnish the State and ASRC, or either of them, with copies of and extracts from any such reports and records.

17. **SUSPENSION.** As more fully provided in subparagraph 4(e) of this lease, either the State or ASRC may from time to time direct or approve in writing suspension of production or other operations under this lease insofar as to the undivided interests in the oil, gas, and associated substances in and under the leased area of the lessor granting the suspension approval. Further, by mutual agreement of both the State and ASRC, the lessors may from time to time direct in writing suspension of production or other operations under this lease, which direction shall be deemed to constitute a suspension approval granted by both the lessors.

18. **ASSIGNMENT, PARTITION, AND CONVERSION.** This lease, or an interest in this lease, may, with the approval of both lessors, be assigned, subleased, or otherwise transferred to any person or persons qualified to hold a lease. No assignment, sublease, or other transfer of an interest in this lease, including assignments of working or royalty interests and operating agreements and subleases, will be binding upon the lessors unless approved by both lessors. The lessee shall remain liable for all obligations under this lease accruing prior to the approval by the lessors of any assignment, sublease, or other transfer of an interest in this lease. All provisions of this lease will extend to and be binding upon the heirs, administrators, successors, and assigns of the lessors and the lessee. Applications for approval of an assignment, sublease, or other transfer must comply with all applicable regulations of the State and must be filed within 90 days after the date of final execution of the instrument of transfer. Each lessor will approve a transfer of an undivided interest in this lease unless the transfer would adversely affect the interests of that lessor or the application does not comply with applicable regulations. Each lessor will disapprove a transfer of a divided interest in this lease if the transfer covers only a portion of the lease or a separate and distinct zone or geological horizon unless the lessee demonstrates that the proposed transfer of a divided interest is reasonably necessary to accomplish exploration or development of the lease, the lease is committed to an approved unit agreement, the lease is allocated production within an approved participating area, or the lease has a well certified as capable of production in paying quantities. Each lessor will make a written finding stating the reasons for disapproval of a transfer of a divided interest. Where an assignment, sublease, or other transfer is made of all or a part of the lessee's interest in a portion of the leased area, this lease may, at the option of and by mutual agreement of both lessors or upon request of the transferee and with the approval of both lessors, be severed, and a separate and distinct lease will be issued to the transferee having the same effective date and terms as this lease.

19. **SURRENDER.** The lessee at any time may file with both lessors a written surrender of all rights under this lease or any portion of the leased area comprising one or more legal subdivisions or, with the consent of both lessors, any separate and distinct zone or geological horizon underlying the leased area or one or more legal subdivisions of the leased area. That surrender will be effective as of the date of filing, subject to the continued obligations of the lessee and its surety to make payment of all accrued royalties and to place all wells and surface facilities on the surrendered land or in the surrendered zones or horizons in condition satisfactory to both lessors for suspension or abandonment. After that, the lessee will be released from all obligations under this lease with respect to the surrendered lands, zones, or horizons.

20. **DEFAULT AND TERMINATION; CANCELLATION.** The failure of the lessee to perform timely its obligations under this lease, or the failure of the lessee otherwise to abide by all express and implied provisions of this lease, is a default of the lessee's obligations under this lease. Whenever the lessee fails to comply with any of the provisions of this lease (other than a provision which, by its terms, provides for automatic termination), and fails within 60 days after written notice of that default from either or both of the lessors to begin and diligently prosecute operations to remedy that default, either or both lessors may terminate this lease insofar as to the undivided interests in the oil, gas, and associated substances in the leased area owned by the lessor or lessors thus electing to terminate this lease if at the time of termination there is no well on the leased area capable of producing oil or gas in paying quantities. If there is a well on the leased area capable of producing oil or gas in paying quantities, this lease may be terminated by an appropriate judicial proceeding. In the event of any termination under this subparagraph, the lessee shall have the right to retain under this lease any and all drilling or producing wells for which no default exists, together with a parcel of land surrounding each well or wells and rights-of-way through the

leased area that are reasonably necessary to enable the lessee to drill, operate, and transport oil or gas from the retained well or wells.

21. RIGHTS UPON TERMINATION. Upon the expiration or earlier termination of this lease as to the interests of both lessors in all or any portion of the leased area, the lessee will be directed in writing by the State and will have the right at any time within a period of one year after the termination, or any extension of that period as may be granted by the State, to remove from the leased area or portion of the leased area all machinery, equipment, tools, and materials. Upon the expiration of that period or extension of that period and at the option of both lessors acting jointly any machinery, equipment, tools, and materials that the lessee has not removed from the leased area or portion of the leased area become the property of both lessors or may be removed by either or both lessors at the lessee's expense. If both lessors elect to acquire title to the machinery, equipment, tools, and materials not removed by lessee, they shall share ownership thereof in proportion to the respective State percentage and ASRC percentage in the oil, gas, and associated substances in and under the land on which the machinery, equipment, tools, and materials are situated. At the option of the State, all improvements such as roads, pads, and wells must either be abandoned and the sites rehabilitated by the lessee to the satisfaction of both lessors, or be left intact and the lessee absolved of all further responsibility as to their maintenance, repair, and eventual abandonment and rehabilitation. Subject to the above conditions, the lessee shall deliver up the leased area or those portions of the leased area in good condition.

22. DAMAGES AND INDEMNIFICATION. (a) No rights under the lease may be exercised by the lessee until the lessee has provided to pay the surface owner, his lessees and permittees, upon which the lease rights are sought to be exercised, full payment for all damage sustained by the owner by reason of entering the land. If the owner for any reason does not settle the damages, the lessee may enter the land after posting a surety bond determined by the State of Alaska, Director of the Division of Oil & Gas, after notice and an opportunity to be heard, to be sufficient as to form, amount, and security to secure to the owner, his lessees and permittees, payment for damages, and may institute legal proceedings in a court of competent jurisdiction where the land is located to determine the damages which the owner of the land may suffer. The lessee agrees to pay for any damages that may become payable under this lease and to indemnify each of the lessors and hold each of them harmless from and against any claims, demands, liabilities, and expenses arising from or in connection with such damages. The furnishing of a bond in compliance with this paragraph will be regarded by the State as sufficient provision for the payment of all damages that may become payable under this lease.

(b) The lessee shall indemnify each of the lessors for, and hold each of them harmless from, any claim, including claims for loss or damage to property or injury to any person caused by or resulting from any act or omission committed under this lease by or on behalf of the lessee. The lessee is not responsible to a lessor under this subparagraph for any loss, damage, or injury caused by or resulting from the sole negligence of that lessor.

(c) The lessee expressly waives any defense to an action for breach of a provision of this lease or for damages resulting from an oil spill or other harm to the environment that is based on an act or omission committed by an independent contractor in the lessee's employ. The lessee expressly agrees to assume responsibility for all actions of its independent contractors.

23. BONDS. (a) If required by the State, the lessee shall furnish a bond prior to the issuance of this lease in an amount equal to at least \$5 per acre or fraction of an acre contained in the leased area, but no less than \$10,000, and must maintain that bond as long as required by the State.

(b) The lessee may, in lieu of the bond required under (a) above, furnish and maintain a statewide bond in accordance with applicable regulations.

(c) The State may, after notice to the lessee and a reasonable opportunity to be heard, require a bond in a reasonable amount greater than the amount specified in (a) above where a greater amount is justified by the nature of the surface and its uses and the degree of risk involved in the types of operations being or to be carried out under this lease. A statewide bond will not satisfy any requirement of a bond imposed under this subparagraph, but will be considered by the State in determining the need for and the amount of any additional bond under this subparagraph.

(d) If the leased area is committed in whole or in part to a cooperative or unit agreement approved or prescribed by the State, and the unit operator furnishes a statewide bond, the lessee need not maintain any bond with respect to the portion of the leased area committed to the cooperative or unit agreement.

24. AUTHORIZED REPRESENTATIVES. The Director of the Division of Oil and Gas, Department of Natural Resources, State of Alaska, shall be the authorized representative for the State for the purposes of administering this lease. The President of ASRC shall be the authorized representative of ASRC for the purposes of administering this lease. The person executing this lease on behalf of the lessee shall be the authorized representative of the lessee for the purposes of administering this lease. The State, ASRC, or the lessee may change the designation of its authorized representative or the address to which notices to that representative are to be sent by a notice given in accordance with Paragraph 25 below. Where activities pursuant to a plan of operations are underway, the lessee shall also designate, pursuant to a notice under Paragraph 25 below, by name, job title, and address, an agent who will be present in the State during all lease activities.

25. NOTICES; PROTEST. (a) Any notices required or permitted under this lease must be by electronic media producing a permanent record or in writing and must be given personally or by registered or certified mail, return receipt requested, addressed as follows:

TO THE STATE:

DIRECTOR, DIVISION OF OIL AND GAS
DEPARTMENT OF NATURAL RESOURCES
3601 C STREET, SUITE 1380
ANCHORAGE, ALASKA 99503-5948

TO ASRC:

VICE PRESIDENT-LAND
ARCTIC SLOPE REGIONAL CORPORATION
P.O. BOX 129
BARROW, ALASKA 99723

TO THE LESSEE:

(b) Any notice given under this paragraph will be effective when delivered to the above authorized representative.

(c) A lessee who wishes to protest the amount of money due a lessor under the lease or any action of a lessor regarding a provision of this lease must file a written protest with *that lessor* within 30 days after the mailing date of that lessor's notice or bill. A lessee who fails to file a protest within the required time waives any further right to protest.

26. STATUTES AND REGULATIONS. This lease is subject to all applicable state and federal statutes and regulations in effect on the effective date of this lease, and insofar as is constitutionally permissible, to all statutes and regulations placed in effect after the effective date of this lease. A reference to a statute or regulation in this lease includes any change in that statute or regulation whether by amendment, repeal and replacement, or other means. This lease does not limit the power of the State of Alaska or the United States of America to enact and enforce legislation or to promulgate and enforce regulations affecting, directly or indirectly, the activities of the lessee or its agents in connection with this lease or the value of the interest held under this lease. In case of conflicting provisions, statutes and regulations take precedence over this lease.

27. INTERPRETATION. This lease is to be interpreted in accordance with the rules applicable to the interpretation of contracts made in the State of Alaska. The paragraph headings are not part of this lease and are inserted only for convenience. The lessors and the lessee expressly agree that the law of the State of Alaska will apply in any judicial proceeding affecting this lease.

28. INTEREST IN REAL PROPERTY. It is the intention of the parties that the rights granted to the lessee by this lease constitute an interest in real property in the leased area.

29. WAIVER OF CONDITIONS. Each of the lessors severally reserves the right to waive any breach of a provision of this lease insofar as to the undivided interests of that lessor in the oil, gas, and associated substances in and under the leased area, but any such waiver extends only to the particular breach so waived and does not limit the rights of that lessor with respect to any future breach; nor will the waiver of a particular breach prevent cancellation of this lease for any other cause or for the same cause occurring at another time. A waiver by only one of the lessors of a breach of a provision of this lease shall not waive that breach as to the other lessor or as to the other lessor's interest in the oil, gas, and associated substances in and under the leased area. Notwithstanding the foregoing, no lessor will be deemed to have waived a provision of this lease unless it does so in writing.

30. SEVERABILITY. If it is finally determined in any judicial proceeding that any provision of this lease is invalid, either or both of lessors and the lessee may jointly agree by a written amendment to this lease that, in consideration of the provisions in that written amendment, the invalid portion will be treated as severed from this lease and that the remainder of

this lease, as amended, will remain in effect insofar as to the lessor or lessors executing that amendment and the interest of that lessor or lessors in the oil, gas, and associated substances in and under the leased area. An agreement amending this lease which is executed by the lessee and one only of the lessors shall not be effective as to the other lessor or as to that other lessor's undivided interests in the oil, gas, and associated substances in or under the leased area.

31. LOCAL HIRE. The lessee is encouraged to hire and employ local and Alaska residents and companies, to the extent they are available and qualified, for work performed on the leased area. Lessees shall submit, with the plans of operations, a proposal detailing the means by which the lessee will comply with this measure. The lessee is encouraged, in formulating this proposal, to coordinate with employment services offered by the State of Alaska and local communities and to recruit employees from local communities.

32. NONDISCRIMINATION. The lessee and the lessee's contractors and subcontractors may not discriminate against any employee or applicant because of race, religion, marital status, change in marital status, pregnancy, parenthood, physical handicap, color, sex, age, or national origin as set out in AS 18.80.220. The lessee and its contractors and subcontractors must, on beginning any operations under this lease, post in a conspicuous place notices setting out this nondiscrimination provision.

33. DEFINITIONS. All words and phrases used in this lease are to be interpreted where possible in the manner required in respect to the interpretation of statutes by AS 01.10.040. However, the following words have the following meanings unless the context unavoidably requires otherwise:

(1) "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;

(2) "gas" means all natural gas (except helium gas) and all other hydrocarbons produced that are not defined in this lease as oil;

(3) "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 lease as oil or gas;

(4) "drilling" means the act of boring a hole to reach a proposed bottom hole location through which oil or gas may be produced if encountered in paying quantities, and includes re-drilling, sidetracking, deepening, or other means necessary to reach the proposed bottom hole location, testing, logging, plugging, and other operations necessary and incidental to the actual boring of the hole;

(5) "reworking operations" means all operations designed to secure, restore, or improve production through some use of a hole previously drilled, including, but not limited to, mechanical or chemical treatment of any horizon, plugging back to test higher strata, etc.;

(6) "paying quantities" means quantities sufficient to yield a return in excess of operating costs, even if drilling and equipment costs may never be repaid and the undertaking considered as a whole may ultimately result in a loss; quantities are insufficient to yield a return in excess of operating costs unless those quantities, not considering the costs of transportation and marketing, will produce sufficient revenue to induce a prudent operator to produce those quantities; and

(7) "force majeure" means war, riots, acts of God, unusually severe weather, or any other cause beyond the lessee's reasonable ability to foresee or control and includes operational failure of existing transportation facilities and delays caused by judicial decisions or lack of them.

34. ROYALTY ON PRODUCTION. Except for oil, gas, and associated substances used on the leased area for development and production or unavoidably lost, the lessee shall pay to the lessors as a royalty 16.66667 percent in amount or value of the oil, gas, and associated substances saved, removed, or sold from the leased area and of the gas from the leased area used on the leased area for extraction of natural gasoline or other products. In the case of each lessor, royalty attributable to the undivided percentage interest of that lessor shall be paid directly to that lessor.

35. VALUE. (a) For the purposes of computing royalties due under this lease, the value of royalty oil, gas, or associated substances shall not be less than the highest of:

(1) the field price received by the lessee for the oil, gas, or associated substances;

(2) the volume-weighted average of the three highest field prices received by other producers in the same field or area for oil of like grade and gravity, gas of like kind and quality, or associated substances of like kind and quality at the time the oil, gas, or associated substances are sold or removed from the leased or unit area or the gas is delivered to an extraction plant if that plant is located on the leased or unit area; if there are less than three prices reported by other producers, the volume-weighted average will be calculated using the lesser number of prices received by other producers in the field or area;

(3) the lessee's posted price in the field or area for the oil, gas, or associated substances; or

(4) the volume-weighted average of the three highest posted prices in the same field or area of the other producers in the same field or area for oil of like grade and gravity, gas of like kind and quality, or associated substances of like kind and quality at the time the oil, gas, or associated substances are sold or removed from the leased or unit area or the gas is delivered to an extraction plant if that plant is located on the leased or unit area; if there are less than three prices posted by other producers, the volume-weighted average will be calculated using the lesser number of prices posted by other producers in the field or area.

(b) If oil, gas, or associated substances are sold away from the leased or unit area, the term "field price" in subparagraph (a) above will be the cash value of all consideration received by the lessee or other producer from the purchaser of the oil, gas, or associated substances, less the reasonable costs of transportation away from the leased or unit area to the point of sale. The "reasonable costs of transportation" are as defined in 11 AAC 83.228 and 11 AAC 83.229 as those regulations exist on the effective date of this lease.

(c) In the event the lessee does not sell in an arm's-length transaction the oil, gas, or associated substances, the term "field price" in subparagraphs (a) and (b) above will mean the price the lessee would expect to receive for the oil, gas, or associated substances if the lessee did sell the oil, gas, or associated substances in an arm's-length transaction, minus reasonable costs of transportation away from the leased or unit area to the point of sale or other disposition. The lessee must determine this price in a consistent and logical manner using information available to the lessee and report that price to lessors.

(d) The State may establish minimum values which shall be applicable for the purposes of computing royalties payable both to the State and to ASRC on oil, gas, or associated substances obtained from this lease, with consideration being given to the price actually received by the lessee, to the price or prices paid in the same field or area for production of like quality, to posted prices, to prices received by the lessee and/or other producers from sales occurring away from the leased area, and/or to other relevant matters. In establishing minimum values, the State may use, but is not limited to, the methodology for determining "prevailing value" as defined in 11 AAC 83.227. Each minimum value determination will be made only after the lessee has been given notice and a reasonable opportunity to be heard. Under this provision, it is expressly agreed that the minimum value of royalty oil, gas, or associated substances under this lease may not necessarily equal, and may exceed, the price of the oil, gas, or associated substances.

36. ROYALTY IN VALUE. Except to the extent that a lessor elects to receive all or a portion of its royalty in kind as provided in Paragraph 37 below, the lessee shall pay to the lessors that value of all royalty oil, gas, and associated substances as determined under Paragraph 35 above. Royalty paid in value will be free and clear of all lease expenses (and any portion of those expenses that is incurred away from the leased area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing the oil, gas, or associated substances for transportation off the leased area. All royalty that may become payable in money to a lessor must be paid on or before the last day of the calendar month following the month in which the oil, gas, or associated substances are produced. The amount of all royalty in value payments which are not paid when due under this lease or the amount which is subsequently determined to be due to the lessors or the lessee as the result of a redetermination will bear interest from the last day of the calendar month following the month in which the oil, gas, or associated substances were produced, until the obligation is paid in full. Interest shall accrue at the rate provided in AS 38.05.135(d) or as may later be amended. Royalty payments must be accompanied by such information relating to valuation of royalty as the lessors may require which may include, but is not limited to, run tickets, evidence of sales, shipments, and amounts of gross oil, gas, and associated substances produced.

37. ROYALTY IN KIND. (a) At the option of either or both lessors, which may be exercised by either lessor (without regard to whether the other lessor exercises or does not exercise that option) from time to time upon not less than 90 days' notice to the lessee, the lessee shall deliver all or a portion of that lessor's royalty oil, gas, or associated substances produced from the leased area in kind. The maximum share of royalty oil, gas, or associated substances which a lessor shall be entitled to require be delivered to it shall be calculated and determined pursuant to and as provided in subparagraph 8(c) of this lease. Delivery will be on the leased area, unit area, or at a place mutually agreed to by a lessor and the lessee, and must be delivered to that lessor or to any individual, firm, or corporation designated by that lessor.

(b) Royalty oil, gas, or associated substances delivered in kind must be delivered in good and merchantable condition, of pipeline quality, and free and clear of all lease expenses (and any portion of those expenses incurred away from the leased area), including, but not limited to, expenses for separating, cleaning, dehydration, gathering, saltwater disposal, and preparing the oil, gas, or associated substances for transportation off the leased area.

(c) After having given notice of its intention to take, or after having taken its royalty oil, gas, or associated substances in kind, a lessor, at its option and upon 90 days' notice to the lessee, may elect to receive a different portion or none of its royalty in kind. If, under federal regulations, the taking of royalty oil, gas, or associated substances in value by a lessor creates a supplier-purchaser relationship, the lessee hereby waives its right to continue to receive royalty oil, gas, or associated substances under that relationship, and further agrees that it will require any purchasers of the royalty oil, gas, or associated substances likewise to waive any supplier-purchaser rights.

(d) The lessee shall furnish storage for royalty oil, gas, and associated substances produced from the leased or unit area to the same extent that the lessee provides storage for the lessee's share of oil, gas, and associated substances. The lessee shall not be liable for the loss or destruction of stored royalty oil, gas and associated substances from causes beyond the lessee's ability to control.

(e) If a lessor's royalty purchaser refuses or for any reason fails to take delivery of oil, gas, or associated substances, or in an emergency, and with as much notice to the lessee as is practical or reasonable under the circumstances, that lessor may elect without penalty to underlift for up to six months all or a portion of that lessor's royalty on oil, gas, or associated substances produced from the leased or unit area and taken in kind. A lessor's right to underlift is limited to the portion of royalty oil, gas, or associated substances that the royalty purchaser refused or failed to take delivery of, or the portion necessary to meet the emergency condition. Underlifted oil, gas, or associated substances may be recovered by a lessor at a daily rate not to exceed 10 percent of its royalty interest share of daily production at the time of the underlift recovery.

38. REDUCTION OF ROYALTY. Lessee may request a reduction of royalty in accordance with the applicable statutes and regulations in effect on the date of application for the reduction. No reduction of royalty payable to ASRC shall be effected without ASRC's approval; and, likewise, no reduction of royalty payable to the State shall be effected without the State's approval.

39. EFFECTIVE DATE. This lease takes effect on

BY SIGNING THIS LEASE, the State, acting for itself and on behalf of ASRC as holder of executive rights pursuant to the Settlement Agreement, and the lessee agree that each of the State, ASRC, and the lessee shall be bound by its provisions.

STATE OF ALASKA

By: _____
Kenneth A. Boyd
Director, Division of Oil and Gas

STATE OF ALASKA)
) ss.
Third Judicial District)

On _____, before me appeared Kenneth A. Boyd of the Division of Oil and Gas of the State of Alaska, Department of Natural Resources, and who executed this lease and acknowledged voluntarily signing it on behalf of the State of Alaska as lessor.

Notary public in and for the State of Alaska
My commission expires _____

LESSEE: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LESSEE'S SIGNATURE HERE.

LESSEE: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LESSEE'S SIGNATURE HERE.

LESSEE: _____

Signature: _____

Printed Name/Title: _____

INSERT NOTARY ACKNOWLEDGMENT OF LESSEE'S SIGNATURE HERE.

