July 30, 2001

Point Thomson Gas Cycling Project

Environmental Report

Prepared for

ExxonMobil

on behalf of the Point Thomson Unit owners

ExxonMobil Production Company
Alaska Interest - Joint Interest U.S.
P.O. Box 196601
Anchorage, Alaska 99519-6601

ExxonMobil
Production

July 27, 2001

To: Distribution

From: Pt. Thomson Unit Owners

Re: Pt. Thomson Gas Cycling Project Environmental Report

Dear Reader:

Attached for your review and comment is a copy of the Pt. Thomson Gas Cycling Project Environmental Report. The preparation of this report has been discussed with most state, federal, and local agencies during meetings over the past few months. As promised, we have prepared the report as a comprehensive review of the available environmental information for the Pt. Thomson region. This report details the currently envisioned conceptual engineering for the Pt. Thomson Gas Cycling Facility, analysis of alternatives, description of affected environment, environmental consequences of the development, and appropriate mitigation measures. Also included is a summary of cumulative impacts for Pt. Thomson in light of currently foreseen regional development.

The attached environmental report was prepared to facilitate agency review of the planned project and to assist in making informed decisions concerning the permitting of the project. We understand that a Presidential Executive Order has recently been issued that directs federal agencies to expedite the review of the permitting of energy-related projects. Accordingly, we would like to pursue an accelerated permit review schedule and we request comments from the federal agencies on how that could be accomplished.

We trust you will find this document a thorough and complete analysis of the Pt. Thomson Unit Development. We are most interested in your overview comments on the document and your opinions on the environmental consequences of the project. We would like to receive your comments within the next four to six weeks, prior to September 14th.

Please forward your comments to:

Dr. A. W. Maki
C/O ExxonMobil Production Company
P. O. Box 196601
Anchorage, Alaska 99519-6601
Phone: 907-564-3702

We look forward to working with you on this project.

Sincerely,

William N. Strawbridge
Chairman - Point Thomson Unit
Working Interest Owners

AWM:ddm
Attachment
AWM\Pt. Thomson\Pt. Thomson Enviro Report 7-25.doc

July 30, 2001

Point Thomson
Gas Cycling Project

Environmental Report

Prepared for

ExxonMobil

on behalf of the Point Thomson Owners

Prepared by

URS
Alaska Operations
5600 B Street
Anchorage, AK 99518

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LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Arctic Coastal Plain
ACMP	Alaska Coastal Management Programs
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADOL	Alaska Department of Labor
ADNR	Alaska Department of Natural Resources
AEWC	Alaska Eskimo Whaling Commission
AF	airstrip facility
AHRS	Alaska Heritage Resource Survey
AIC	Alaska Interstate Construction
ANCSA	Alaska Native Claims Settlement Act
ANS	Alaska North Slope
ANSER	Alaska North Slope Eastern Region
ANWR	Arctic National Wildlife Refuge
ASTT	Arctic small tool tradition
BACT	Best Available Control Technology
bbls	barrels
BCF	Bioconcentration Factor
BPXA	BP Exploration- Alaska
BTU	British thermal units
°C	degrees Celsius
CAH	Central Arctic Herd (caribou)
CCF	Construction Camp Facility
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIP	Capital Improvements Program
cm	centimeter(s)
cm/sec	centimeters per second
CNS	Central Nervous System
CO	carbon monoxide
C-Plan	Oil Discharge Prevention and Contingency Plan
CPF	Central Processing Facility
CPU	Central Processing Unit
CRA	Corrosion Resistant Alloy
CWP	Central Well Pad
cy	cubic yards
dB	decibel(s)
dBA	decibels, A-scale weighting

LIST OF ACRONYMS AND ABBREVIATIONS

DEW	Distant Early Warning (Line)
DWM	Drilling Waste Management
EC_{50}	Effective Concentration of a drug that causes 50% of maximum response
E&P	Exploration and Production
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ER	Environmental Report
ERD	Extended Reach Drilling
ESA	Endangered Species Act
°F	degrees Fahrenheit
FD	Field Development
FLIR	forward-looking infrared radar
ft	foot, feet
ft^3	cubic feet
G&I	grind and inject
gal	gallons
gal/mi	gallons per mile
GIS	Geographical Information System
GM	Gravel Mine
GMU	Game Management Unit
gpd	gallons per day
GPS	Global Positioning System
GR	Gravel Reuse
Ha	hectares
HDPE	High Density Polyethylene
hr	hour, hours
Hz	Hertz
IHA	Incidental Harassment Authorizations
IHLC	Inupiat History, Language, and Culture Commission
in	inch, inches
kg	kilogram
kHz	kilo hertz
km	kilometer(s)
km/hr	kilometers per hour
kts	knots
l	liters
liters/day	liters per day
lbs	pounds
LD_{50}	Lethal Dose that causes death in 50% of subjects
LMR's	Land Management Regulations

LIST OF ACRONYMS AND ABBREVIATIONS

m	meter(s)
m^3	cubic meters
m^3/sec	cubic meters per second
MD	marine dock
$\mu g/m^3$	micrograms per cubic meter
Mg	milligrams
mg/L	milligrams per liter
mi	mile(s)
mi^2	square miles
mm	millimeter(s)
MMPA	Marine Mammal Protection Act
MMS	Department of the Interior, Mineral Management Service
mph	miles per hour
MW	megawatt(s)
MWP	maximum working pressure
N/A	not applicable
NEPA	National Environmental Protection Agency
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_X	nitrous oxide(s)
NPDES	National Pollution Discharge Elimination System
NPRA	National Petroleum Reserve Alaska
NSB	North Slope Borough
NTU	Nephelometric turbidity units
OHA	Office of History and Archeology
OIMS	Operation Integrity Management System
%	Percent
PCF	Permanent Camp Facility
PCH	Porcupine Herd (caribou)
PF	Power Facility
pH	potential of hydrogen (measures the acidity or alkalinity of a substance)
PM	Pipeline Mode
ppm	parts per million
ppt	part per thousand
psi	pounds per square inch
psig	pounds per square inch gauge
RF	Radio Frequency
RD	Road Development
ROW	Right of Way
sec	second(s)

LIST OF ACRONYMS AND ABBREVIATIONS

State	State of Alaska
SO_2	sulfur dioxide
TAPS	Trans Alaska Pipeline System
TLH	Teshekpuk Lake Herd (caribou)
TLUI	Traditional Land Use Inventory
TSS	total suspended solids
U.S.	United States
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds
VSMs	vertical support members
WAH	Western Arctic Herd (caribou)
WDC	West Dock Causeway
YOY	young-of-the-year

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EXECUTIVE SUMMARY

ExxonMobil, BP Exploration (Alaska) Inc., Chevron USA, Phillips Alaska Inc. and other Point Thomson Unit lease holders are evaluating the opportunity to develop the Point Thomson Unit for the production and transport of natural gas hydrocarbon condensate. The Point Thomson Gas Cycling Project involves the cycling of gas in the Point Thomson Sands reservoir to recover liquid hydrocarbon condensate. A Central Production Facility (CPF) will process the 3-phase product produced from well pads located on the eastern (East Well Pad) and western (West Well Pad) margins of the reservoir. Lean gas will be re-injected into the formation at a third pad (Central Well Pad), located adjacent to the CFP. Project support facilities include an airstrip, dock, infield road system connecting the well pads and the CPF, a gravel mine, and a water source in an abandoned mine site. A sales pipeline will extend to the Badami Sales Oil pipeline where the two lines will be connected. There are no plans for an access road to connect Point Thomson with Badami or other existing oil field facilities to the west.

The Point Thomson Sands reservoir is located both onshore and offshore of Lions Lagoon about 20 miles (32 kilometers) east of the Badami field. In the winter of 2004/2005 ExxonMobil and the other owners plan to build a sea ice road from Endicott to Point Thomson and mobilize heavy equipment, construction camps, and personnel to the proposed project site. The first activity will be to develop a gravel mine near the proposed project site in early 2005. Construction of gravel field facilities, including well and CPF pads, dock, airstrip and infield roads will follow during the same winter. All processing modules, early power equipment, grind and inject modules, and other necessary equipment and infrastructure will either be trucked on the sea ice road or barged to the project site by August 2005. During the summer of 2005, pads, roads, the dock and airstrip will be re-graded and shaped. Nearshore dredging activities off the dockhead will also be conducted during the summer of 2005. Development drilling will begin in the winter of 2005/2006, with simultaneous pipeline construction and civil construction of the CPF modules. Project start-up is expected to commence by the end of 2006.

Several design options for various project components were analyzed in Section 2 of this Environmental Report (ER), which resulted in the chosen design. These design options included:

- Location of Field Development
- Construction Camp Facilities
- Permanent Camp Facilities
- Power Facilities
- Drilling Waste Management
- Marine Dock Access
- Airstrip Access
- Roadless Development
- Pipeline Mode
- Gravel Mine Options

- Gravel Reuse Options

Components carried forward from in Section 2 were brought forward for inclusion in the project description, which is described in detail in Section 3. As provided in this document, the project description represents the extent of development conceptually planned at this time.

Two spatial or geographic areas for potentially affected environment for this ER were identified. The first is defined as a spatial area of interest from the Colville River east along the coastal plain to Kaktovik, from the coastal plain south to the Brooks Range, and seaward of the barrier islands to the north (Note: for caribou this area was modified, the western boundary moved east to the Sagavanirktok River). The second spatial area of interest is from the Badami Facility east to the Canning River, north to the barrier islands, and to the southern boundary of the Point Thomson Unit. The affected environment discussions in Section 4 include the following resource categories:

- Physical/Chemical - including air, freshwater and marine water quality, surface hydrology, and permafrost
- Biological – including marine benthos, vegetation, birds, fish, marine mammals, terrestrial mammals, and threatened and endangered species.
- Social/Cultural – including socioeconomic, cultural, visual and aesthetic and recreational value

Environmental consequences of the proposed action at Point Thomson have the potential to impact the physical, biological, and social/cultural resources of the area. The following table describes the potential impacts, their anticipated severity, and possible mitigation measures to lessen impacts. Section 5 provides details of the potential environmental consequences on a resource-by-resource basis, and Section 6 describes potential mitigation measures. These analyses are summarized on the following table.

PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POTENTIAL MITIGATION MEASURES
Physical/Chemical			
Air Quality	Y(NS)	• Project will also fall under New Source Performance Standards • Impacts could occur, but mitigation will decrease significance • Point Thomson not expected to contribute significantly to arctic haze	• Design minimizes diesel-fired sources • Reduces emissions of Nitrous Oxide through Best Available Control Technology • Construction activities staggered to minimize concurrent sources • Design tanks with pressure/vacuum release devices and vapor recovery • Water gravel surfaces to reduce dust generation • Strictly enforce minimum speed limits
Surface Hydrology	Y(NS)	• Impacts could occur, but mitigation will decrease significance	• Project constructed with minimal footprint • Culverts reduce flow impacts • Prevent icing/blockage of culverts; manual removal of ice when required; inspect to assure proper flow is occurring • Winter gravel mining and construction • Locate pads, roads, and airstrip to minimize blockage of natural drainage • Manage snow removal
Freshwater Quality	Y(NS)	• Majority of construction impacts on turbidity minimized due to timing (winter) • Impacts could occur, but mitigation will decrease significance	• Locate gravel mine to minimize impacts to freshwater resources • Limit water removal under ice in any fish bearing lakes so as not to exacerbate low dissolved oxygen levels in winter • Eliminate operational discharges by using injection wells • Design facilities to minimize and control stormwater/snowmelt surface drainage • Design and construct a wastewater treatment system should primary injection become unavailable • Develop and implement treatment, and best management practices for all wastewater streams and stormwater discharges
Marine Water Quality	Y(NS)	• Short-term increases in turbidity not expected to be significant and likely within range of natural perturbations	• Majority of construction impacts on turbidity minimized due to timing (winter) • Summer dredging and spoils disposal will create short-term impacts on marine water

Y = Yes
N = No
NS = Not significant

S = Significant
S^+ = Significant and positive
N/A = Not applicable

PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE (Cont.)

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POSSIBLE MITIGATION MEASURES
Physical/Chemical (Con't)			
Marine Circulation	Y(NS)	• Wake eddy from dock could be present, but effects will not be significant	• Proposed design utilizes shorter dock length [dock length shortened from original 2000 ft (610 m) to current 750 ft (229 m)]
Permafrost/soils	Y(NS)	• Impacts could occur, but mitigation will decrease significance • Project will minimize footprint	• Majority of construction impacts on permafrost minimized due to timing (winter) • Use 5-ft (1.52-m) thick gravel pads will protect and insulate permafrost
Marine Benthos			
Habitat Loss, Disturbance and Mortality	Y(NS)	• Habitat not limiting to these opportunistic species which are impacted by natural events such as ice scour each winter	N/A
Vegetation			
Habitat Loss and/or Alteration (disturbance and mortality considered under context of habitat effects)	Y(NS)	• Habitats affected are not limiting for wildlife species in the area	• Minimize gravel pad footprints • Utilize Extended Reach Drilling directional drilling techniques • Minimize infrastructure and infield road distances • Minimize infield access road crown width; use 2:1 slope • Reuse Point Thomson #3 pad • No road connecting facility to other oil fields located to the west • Use ice roads for construction and seasonal access • Reuse gravel from existing pads where possible • Conduct major construction efforts in winter for infield roads, pads, pipeline and airstrip • Use ice roads for seasonal access • Design facilities to minimize impacts to drainage and permafrost • Utilize dust control measures such as applying water to roads and enforcing speed limits • Institute and enforce environmental sensitivity training for construction and operations personnel • Design emergency response and containment procedures in case of a spill • Rehabilitate and re-seed any impacted areas and monitor restoration

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PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE (Cont.)

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POSSIBLE MITIGATION MEASURES
Fish			
Habitat Loss, Disturbance and Mortality	Y(NS)	• Effect is limited to nearshore foraging habitat for freshwater, diadromous, and marine fish • Limited to potential effects from maintenance dredging • Turbidity increases short term • Fish in nearshore waters are tolerant of turbid water • Fish Habitat Permit required: water withdrawal limitations are conservative and protective • Fish mortality from fishing and scientific surveys is small relative to overall population levels • Sport fishing is regulated by the State	• Do not use streams for water source in winter • Limit work in streams in known spawning areas and prevent work during fish spawning runs, if any • Winter construction for gravel mining and gravel placement • Prevent obstructions to fish migration • Limit winter water withdrawal in fish bearing lakes, if any in area, to 15% of available water under ice • Minimize stream crossings and construction activities in streams • Mine gravel for roads and pads during winter only • Do not cut stream banks for access, use ice or snow ramps • Use appropriate means to stabilize banks • Assure normal ice breakup by removing blockages in culverts and breach ice roads as needed • Institute and enforce environmental sensitivity training for all personnel • Only cross streams (tundra travel) where solidly frozen
Birds			
Habitat Loss/Alteration, Disturbance, Mortality	Y(NS)	• Onshore nesting habitat not limited • Short-term impacts could occur due to construction noise; however, disturbance would be greatest in winter when most birds are not present	• Avoid flyways, molting, and nesting areas • Properly manage wastes and garbage • Prohibit feeding by personnel • Strictly enforce speed limits within project area • Proper siting of culverts to minimize creation of temporary impoundments • Limit water removal from freshwater lakes • Limit aircraft to specific routes • Prepare wildlife interaction plan

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PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE (Cont.)

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POSSIBLE MITIGATION MEASURES
Pinnipeds			
Disturbance (habitat effects considered under context of disturbance)	Y(NS)	• Short-term impacts due to summer dredging and winter gravel placement • Data collected during Northstar construction efforts showed no impact to distribution or abundance of ringed seals • Population level effects not expected • Minimal offshore or nearshore disturbance expected during operations	• Minimize construction noise during all seasons by using and maintaining high quality mufflers and sound proofing where available • Minimize offshore impacts by using the shortest possible dock and minimizing barge trips by carrying full loads where possible • Institute and enforce environmental resource sensitivity training for construction and operations personnel • Avoid haul-out areas, should any be identified in the transportation routes • Limit helicopter to overland flight routes • Build sea-ice road on grounded ice (not seal habitat) • Begin sea-ice road construction as early as possible
Mortality	N	• Direct mortality from development of Point Thomson not expected	N/A
Polar Bears			
Habitat Loss and Alteration, Disturbance, and Mortality	Y(NS)	• Active denning sites will be avoided • No known areas of long-term displacement • No evidence that noise associated with construction or operation disturbs polar bears • Continued use of numerous den sites on Flaxman Is. even though exploration, remediation, and scientific surveys have taken place there • Impact exists due to potential need to kill a bear to protect life or property, however, the potential that this will happen is very low	• Develop and implement polar bear interaction plan • Partner with United States Fish and Wildlife Service (USFWS) in yearly polar bear surveys and studies • Conduct major construction efforts in winter • Utilize facility design that minimizes polar bear and human interactions • Locate and avoid historic polar bear denning areas • Avoid dens by 1 mile • Use forward-looking infrared radar (FLIR) to locate den sites along ice road routes • Ensure appropriate set back from denning areas • Report any den encountered • Manage wastes to avoid attracting polar bears • Institute and enforce environmental sensitivity training for construction and operations personnel • Use bear-proof dumpsters

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PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE (Cont.)

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POSSIBLE MITIGATION MEASURES
Central Arctic and Porcupine Caribou Herds			
Habitat Loss/Alteration, Disturbance, and Mortality	Y(NS)	• Habitat is not limiting • Project minimizes gravel footprint • Major construction would occur in the winter • Traffic volumes are expected to be low • Vehicle strikes minimized by enforced speed limits • Mortality associated with scientific work rarely occurs • Hunting by project personnel will be prohibited	• Use 5-ft (1.5-m) high pipelines • Design infield road and pipeline with a 500-ft (152- m) separation • Conduct major construction efforts in winter for infield roads, pads, pipeline and airstrip • Route helicopters to minimize wildlife disturbance – consultation with USFWS • Institute and enforce environmental sensitivity training for all personnel • Strictly enforce speed limits within project area • Institute a no hunting policy for site workers • Prepare wildlife interaction plan
Other Terrestrial Mammals			
Habitat Loss/Alteration, Disturbance, and Mortality	Y(NS)	• Project minimizes gravel footprint • Major construction would occur in the winter • Traffic volumes are expected to be low • Vehicle strikes minimized by enforced speed limits • Mortality associated with scientific work rarely occurs • Hunting by project personnel will be prohibited	• Properly manage wastes • Prohibit feeding by personnel • Institute and enforce environmental sensitivity training for construction and operations personnel • Strictly enforce speed limits within project area • Use bear-proof dumpsters

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PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE (Cont.)

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POSSIBLE MITIGATION MEASURES
Bowhead Whales			
Habitat Loss/ Alteration and Disturbance	Y(NS)	• Non significant effects since bowheads will not be in the area during winter construction • Summer dredging efforts will occur inside the barrier islands and spoils disposal will be completed prior to the fall migration. There could be some disturbance due to boat and vessel traffic, but will be mitigated. • Bowheads typically migrate offshore of barrier islands; nearshore and onshore activities not expected to cause an impact	• Minimize construction noise especially during whale migration periods by using and maintaining high quality mufflers and sound proofing (where available) • During fall and spring migration route vessel traffic inside the barrier islands and limit helicopter flights to overland routes to minimize disturbance to migrating whales • Institute and enforce environmental resource sensitivity training for construction and operations personnel • Non-harassment procedures would also be in place
Mortality	N	• Direct mortality from development of Point Thomson not expected	N/A
Spectacled Elder			
Habitat Loss and Alteration, Disturbance, and Mortality	Y(NS)	• Point Thomson region is at eastern range of species • Nesting habitat not limiting • Point Thomson development minimizes footprint and mitigates impacts to these birds	• Coordinate with USFWS on Spectacled eider surveys • Conduct major construction efforts in winter for infield roads, pads, pipeline and airstrip • Institute and enforce environmental resource sensitivity training for construction and operations personnel
Socioeconomics			
Population Increase	Y (NS)	• Project not large enough to generate significant population changes in local communities or the State	N/A

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PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE (Cont.)

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POSSIBLE MITIGATION MEASURES
Socioeconomic (Cont.)			
Increase in Employment Opportunities	Y(S^+)	• Project-generated local employment is significant in a climate of decreasing NSB and other employment opportunities	N/A
Increase in Public Revenues	Y(S^+)	• Project-generated revenue for the NSB and State is significant in a climate of decreasing revenues • Project-generated NSB and State revenue that funds local employment is significant in a climate of decreasing opportunities	N/A
Subsistence			
Disruption of fall whale hunt and other marine subsistence activities	Y(NS)	• Bowheads typically migrate offshore of barrier islands; nearshore and onshore activities not expected to cause an impact • Boat traffic will be halted outside of the barrier islands during the fall whale hunt • Mitigation measures and non-harassment procedures would also be in place	• Any offshore construction associated with other developments would be timed so as not to impact migrating whales • Route vessel traffic inside the barrier islands to minimize disturbance to subsistence activities • Institute and enforce subsistence resource sensitivity training for construction and operations personnel • Obtain and respond to community input • Coordinate offshore activities such as barge traffic with subsistence communities and the Alaska Eskimo Whaling Commission (AEWC) • Develop conflict avoidance agreements, if needed
Disruption or competition to terrestrial subsistence resources	Y(NS)	• Major construction would occur in the winter • Traffic volumes are low • Separation between potential future pipelines and roads • Sufficient elevation of potential future aboveground pipelines	• Identify subsistence use and areas potentially affected by the project • Conduct major construction efforts in winter for infield roads, pads, pipeline, and airstrip • Prohibit hunting by construction and operations • Obtain and respond to community input

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PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE (Cont.)

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POSSIBLE MITIGATION MEASURES
Subsistence (Cont.)			
Disruption from contamination or perception of contamination	Y(NS)	• Probability of a spill occurring is extremely low • Mitigation measures and spill prevention response measures would be in place	• Design facility for zero discharge of drilling wastes • Utilize corrosion resistant alloy for gathering lines • Provide leak detection, monitoring and operating procedures for the gathering and sales lines • Use on-site fuel gas for power when it becomes available. Note: diesel will always be available for backup. • Ensure adequate spill response equipment and personnel are available to respond • Build spill controlling berm strategies into pad • Locate pipeline route south of infield road so that road provides containment in case of a leak • During construction, locate fuel storage and transfer locations away from river crossings and wetlands • Use secondary containment at all fuel storage locations • Train personnel in acceptable refueling procedures and allowed locations for refueling • Use drip pans and liners during refueling and vehicle maintenance procedures
Land Use			
Point Thomson area gas and oil development	Y(S)	• Some facilities constructed for this project could be used to support the development at Sourdough	• Consistent with oil and gas leases and lease sale conditions
Extension of North Slope onshore oil and gas development to the east	Y(S)	• Project represents an expansion of oil and gas land use east of the existing development at Badami	N/A
Transportation			
Increased vessel traffic on annual sealift	Y(NS)	• Sea-lifting of Point Thomson modules will not perceptibly increase traffic during annual sealift	• Logistical planning will minimize effects

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PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE (Cont.)

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POSSIBLE MITIGATION MEASURES
Transportation (Cont.)			
Increased traffic on Dalton Hwy and within Prudhoe Bay	Y(NS)	• Construction and operations at Point Thomson will not perceptibly increase traffic	• Logistical planning will minimize effects
Increased marine traffic along coast	Y(NS)	• The direct volume of increased marine traffic along the coast is not significant • Any impacts can be mitigated	• Plan shipments so that full loads are carried • Plan vessel routes so that sensitive areas/species are not affected
Increased air traffic on the North Slope	Y(NS)	• The direct volume of increased air traffic is not significant • Any impacts can be mitigated	• Plan shipments so that full loads are carried • Plan air routes so that sensitive areas/species are not affected
Recreation			
Impairment of localized recreational experience through presence of industrial facility within view and earshot	Y(S)	• Introduction of construction and operation of industrial facilities and activities into a relatively undeveloped area adjacent to non-resident recreation areas • Mitigation measures will lessen effect	• Utilize fuel gas for generator fuel, energy efficiency, and emission controls • Reduce indirect lighting as much as possible • Reduce structural profile where practical. Highest structure is the microwave tower at approximately 300 ft (91m). • Use natural color schemes that blend with environment
Aesthetic Values			
Decrease of localized aesthetic beauty for residents	Y(NS)	• North Slope Borough residents infrequently use the project area	• Utilize fuel gas for generator fuel, energy efficiency, and emission controls • Reduce indirect lighting as much as possible • Reduce structural profile where practical. Highest structure is the microwave tower at approximately 300 feet. • Use natural color schemes that blend with environment
Decrease of localized aesthetic beauty for visitors	Y(S)	• Introduction of construction and operation of industrial facilities and activities into an undeveloped area adjacent to non-resident recreation areas	• Utilize fuel gas for generator fuel, energy efficiency, and emission controls • Reduce indirect lighting as much as possible • Reduce structural profile where practical. Highest structure is the microwave tower at approximately 300 feet. • Use natural color schemes that blend with environment

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PROJECT EFFECTS AND MITIGATION MEASURES SUMMARY TABLE (Cont.)

RESOURCE/IMPACT	POTENTIAL PROJECT EFFECTS?	RATIONALE	POSSIBLE MITIGATION MEASURES
Cultural Resources			
Disturbance to or destruction of cultural resource sites	N	• Mitigation measures for avoiding disruption to or destruction of cultural resources sites will be implemented	• Locate and avoid archeological sites • Obtain and incorporate local information about important historical sites • Maintain confidentiality of site locations • Institute and enforce cultural resource sensitivity training for construction and operations personnel

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Section 7 of this ER evaluates the potential cumulative effects of the Point Thomson Gas Cycling Project when considered in combination with other external actions or factors. The cumulative effect analyses follows the National Environmental Policy Act (NEPA) and uses Council on Environmental Quality (CEQ) guidelines. External factors considered in the analysis included past, present, and reasonably foreseeable events such as:

Human Controlled Actions

- Oil and Gas Exploration and Development: Includes past exploratory and Badami development, Badami operations, and reasonably foreseeable future exploration and development. Reasonably foreseeable includes exploration and/or development for which technical work is currently in progress or where Point Thomson Gas Cycling development might improve development feasibility. Foreseeable future projects are not part of the proposed action and would require authorization under a separate local, state, and federal permit process.
- Scientific Research and Surveys: past, present, and future oceanographic and biological work conducted within the geographic scope with the potential to impact identified biological resources.
- Industrial Pollutants: past, present, and future global industrial air pollutants (including North Slope), global industrial pollutants with the potential to affect North Slope resources.
- Subsistence Activities: past, present, and future potential impacts to identified resources.
- Borough and State Tax and Royalty Revenues Generated by the Petroleum Industry: Past, present, and future potential North Slope Borough and State of Alaska tax and royalty revenues generated by petroleum industry projects
- Commercial Fishing: past, present, and future potential impacts to identified resources.
- Tourism and Recreation: past, present, and future potential impacts to identified resources.
- Military: past, present, and future potential impacts from the Bullen Point DEW Line Station.

Natural Events

- Disease: present and future viral infections affecting long-tailed ducks.
- Weather/Seasonal: past, present, and future ice scour; increased turbidity due to breakup, storms, and wave actions; and foggy weather.

The following table summarizes the results of the Cumulative Effects analysis for the project areas and defines geographic and temporal scope.

CUMULATIVE EFFECTS SUMMARY TABLE
Physical/Chemical, Biological, Socioeconomic, and Cultural Resources

RESOURCE/IMPACT	CUMULATIVE EFFECT IDENTIFIED?		LIKELIHOOD THAT CUMULATIVE EFFECT COULD BE CONSIDERED SIGNIFICANT
	YES	NO	
Physical/Chemical			
Air Quality	✓		LOW
Surface Hydrology	✓		LOW
Freshwater Quality	✓		LOW
Marine Water Quality	✓		LOW
Marine Circulation	✓		LOW
Permafrost/soils	✓		LOW
Marine Benthos			
Habitat Loss and Mortality	✓		LOW
Habitat Alteration and Disturbance	✓		LOW
Vegetation			
Habitat Loss and/or Alteration[1]	✓		LOW
Fish			
Habitat		✓	N/A
Disturbance	✓		LOW
Mortality	✓		LOW
Birds			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Pinnipeds			
Disturbance[2]	✓		LOW
Mortality		✓	N/A
Polar Bears			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Central Arctic Caribou Herd			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Porcupine Caribou Herd			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Other Terrestrial Mammals			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Bowhead Whales			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality		✓	N/A

CUMULATIVE EFFECTS SUMMARY TABLE
Physical/Chemical, Biological, Socioeconomic, and Cultural Resources

RESOURCE/IMPACT	CUMULATIVE EFFECT IDENTIFIED?		LIKELIHOOD THAT CUMULATIVE EFFECT COULD BE CONSIDERED SIGNIFICANT
	YES	NO	
Spectacled Eider			
Habitat Loss and Alteration	✓		LOW
Disturbance	✓		LOW
Mortality	✓		LOW
Socioeconomics			
Population Change		✓	N/A
Increase in Employment Opportunities	✓		HIGH
Increase in Public Revenues	✓		HIGH
Subsistence			
Disruption of fall whale hunt	✓		LOW
Disruption of other marine subsistence		✓	N/A
Disruption or competition to terrestrial subsistence resources	✓		LOW
Disruption from contamination or perception of contamination	✓		LOW
Land Use			
Extension of gas and oil development	✓		HIGH
Transportation			
Increased marine, terrestrial and aerial traffic	✓		LOW
Recreation			
Impairment of localized recreational experience	✓		HIGH
Aesthetic Values			
Decrease in localized aesthetic beauty to residents	✓		LOW
Decrease in localized aesthetic beauty to visitors	✓		HIGH
Cultural Resources			
Disturbance to Destruction of Cultural Resource sites	✓		LOW

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Environmental Report (ER) is to evaluate a proposal by ExxonMobil and its partners, including BP Exploration (Alaska) Inc., Chevron USA, Phillips Alaska, Inc., and others to develop the Point Thomson Unit for the production and transport of natural gas hydrocarbon condensate. This document is designed to provide information to support the agency permitting/approval process. The Point Thomson field will be developed first as a gas cycling project with the possibility of Brookian oil and/or gas sales following at an unspecified future date. The Unit is located on the eastern North Slope of Alaska immediately west of the Canning River, and approximately 20 miles (mi) (32.2 kilometer [km]) east of the Badami Development (Figure 1-1). All production facilities, with the exception of a barge dock adjacent to the Central Well Pad (CWP), will be land based.

Point Thomson Sands is a high-pressure gas reservoir that was discovered in 1973. The Point Thomson Sands reservoir is estimated to contain more than 8 trillion cubic feet (0.23 trillion cubic meters) of gas and over 200 million stock tank barrels of recoverable condensate. A Central Processing Facility (CPF) will gather and process the 3-phased stream produced from well pads located on the eastern and western margins of the reservoir. Gas, water, and hydrocarbon condensate will be separated from the 3-phase stream. Lean gas will be re-injected into the formation at the CWP located near the CPF. Produced water will also be re-injected into a disposal well(s) at the CWP.

Condensate is the hydrocarbon liquid that condenses from the 3-phase stream as the stream is expanded from the high pressure, high temperature reservoir conditions to the lower pressure, cooler conditions in the surface gathering and processing facilities. Condensate is a low density, low viscosity hydrocarbon liquid at standard conditions (i.e., atmospheric pressure and 60 degrees Fahrenheit). Clean, pure condensate will typically be a clear liquid. It is expected that the Point Thomson export condensate will be a cloudy to light brown liquid as it will contain a small amount of sediment and water (i.e., combined total volume less than 0.35 percent), and small amounts of other liquid hydrocarbon constituents.

A sales pipeline will be built to transport the hydrocarbon condensate through a tie-in with the existing Badami sales oil pipeline located about 22 mi (35.4 km) west of the proposed Point Thomson CPF location. From Badami, the liquid product will be transported through the existing Badami and Endicott common carrier pipelines to the Trans Alaska Pipeline System (TAPS). In addition to condensate, the project basis includes the potential to accommodate limited production of heavy oil from the Point Thomson oil rim.

The potential for gas sales from the Point Thomson facility could be realized with the completion of a gas pipeline to the Lower-48. Depending on the sales pipeline route and sales gas specifications, additional Point Thomson facilities would be required to accommodate gas sales including gas dehydration, gas pipelines, and/or gas treating/conditioning facilities. Point Thomson's role in a possible near term gas sales scenario has not yet been defined. The overall viability of a gas sales pipeline must first be confirmed. Prudhoe Bay and Point Thomson Unit owners must also study the costs and benefits associated with early gas sales versus gas cycling (selling gas at a later date) at Point Thomson. This report assumes that gas cycling is the near-term development method. Should unit owners subsequently reach a decision that early gas sales from Point Thomson is more viable than cycling, current permitting and environmental assessments will need to be modified accordingly.

In the past, the area has been explored for accumulations of Brookian-age oil. Based on current evaluations, it is questionable if these reservoirs can be economically produced at this time. Although, the potential of the Brookian reservoir will be further explored while drilling through the Point Thomson Sands gas reservoir, the current project scope does not include development of the Brookian.

1.2 NEED

Development of this resource is needed to meet domestic energy demand. Production of condensate could be as high as 75,000 barrels per day for the three-train base case. Production could last for as long as 30 years.

The Point Thomson Gas Cycling Project will provide economic benefits to the working interests and property owners, as well as residents of the North Slope Borough (NSB), the State of Alaska (State), and the United States (U.S.). North Slope drilling and construction jobs may be created during the construction phase, with permanent operations jobs available during the operations phase. Over the life of the project, additional benefits will accrue to the State and NSB through the payment of royalties, severance, income, and *ad valorem* taxes.

1.3 PROJECT SCOPE AND PROPOSED MILESTONES

The major components of the project are:

- Two production well pads situated near the eastern and western ends of the reservoir where producing wells are drilled and metering and control equipment are located.
- Elevated gathering pipelines constructed of a corrosion resistant alloy (CRA) carrying pressurized 3-phase stream from each of the well pads to a CPF.
- CPF facilities, which separate gas, produced water, and hydrocarbon condensate from the 3-phase stream.
- An elevated carbon steel pipeline, which transports the stabilized hydrocarbon condensate to a connection with the existing Badami Pipeline (export condensate is non-corrosive).
- Gas turbine driven injection compressors at the CPF that re-injects the lean gas into wells located at a central well pad, adjacent to the CPF.
- A grind and inject (G&I) system and a United States Environmental Protection Agency (EPA) Class I disposal well located at the central well pad, which are used to grind up cuttings from the drilling operations and inject the cuttings along with produced water, wastewater, and liquid wastes from the CPF.
- A self-sufficient infrastructure which is not connected by road or utilities to any other North Slope infrastructure. This infrastructure includes operations and construction man camps, electric power generating and distribution facilities, fuel storage, water treating and storage, communications facilities, and a local airstrip for personnel and equipment access.

- A dock in the Lions Lagoon, adjacent to the CPF and central well pad used for installation of large facilities modules, mobilization of drilling rigs and related equipment, and delivery of bulk materials and supplies during drilling, construction, and operating phases of the project. The dock would also serve as a point to stage emergency and spill response equipment.
- A gravel mine site that would be converted to a water reservoir (fresh water source for operations) when gravel extraction is complete.
- Winter ice roads used for construction and future use, as needed, in support of special operations.

The major milestones of the Point Thomson Gas Cycling Project are shown in Table 1-1. ExxonMobil and its partners' are striving to have the project in production by the end of 2006.

1.4 DEVELOPMENT CHALLENGES AND PHILOSOPHY

Certain measures, some of which are due to Point Thomson's remoteness from existing infrastructure, are planned to reduce environmental impacts and capital costs of the development, including:

- Shore-based extended reach drilling from a minimum number of well pads.
- Use of CRA piping for infield gathering lines.
- Use of existing Badami sales oil pipeline to transport condensate to TAPS.
- No permanent roads to Badami or Prudhoe Bay infrastructure.
- Use of existing exploration pads and gravel where possible.
- Zero discharge policy for drilling wastes, which will be injected into a Class I well.
- Use of existing and new gravel mines at Point Thomson for fresh water sources.
- Use of best available control technology to minimize air emissions.
- Timing of construction operations to minimize potential disturbance to subsistence hunters and whaling crews.

1.5 PROJECT PLANNING AND STAKEHOLDER INVOLVEMENT

ExxonMobil and its partners understand that careful project planning and community education are key to obtaining both stakeholder and general public support for development in the Point Thomson area. By building strong alliances with both State and local communities as well as with the business community, public support for the project will be encouraged. Plans include:

- Conducting regular open discussions with representative State and federal agencies
- Working closely with the NSB Planning Department and stakeholders, including potentially affected communities on the North Slope;; and
- Providing stakeholders, regulators, and other interested parties with timely information as required to assist in their evaluation of project issues.

Table 1-1 Point Thomson Gas Cycling Project Major Milestones

MILESTONE	TIME FRAME	DESCRIPTION
Conceptual Engineering	Aug 1998 - April 2001	
Additional Environmental Studies	Summer 2001	The results of environmental studies conducted previous to 2001 are summarized in Section 4 of this document. Additional environmental studies are planned for 2001.
Preliminary Engineering Detailed Engineering/ Procurement	1st Half of 2002 - March 2005	
Gravel Construction	Dec 2004 - April 2005	Gravel construction is expected to commence late in 2004 utilizing equipment mobilized over ice roads. Most gravel work at the project site is expected to be completed in a single winter season, with gravel obtained from a new local mine site.
Mobilize Rigs by barge	Late summer 2005	Rigs are delivered to the new dock adjacent to the central well pad.
Infrastructure Construction	Feb – Sept. 2005	Construction of infrastructure such as airport, power generation, storage tanks, temporary camps, and dock to support drilling operations.
Development Well Drilling	Sept. 2005	Drilling is conducted with two rigs
Pipeline Construction	Dec 2005 - May 2006	Pipeline construction is expected to commence in winter 2005 and be completed by May 2006.
Sealift	June - Sept 2006	Major modules for CPF are brought to Point Thomson by sealift in the summer of 2006 and offloaded at the dock.
Module Installation	Sept - Dec 2006	
Production	4th Quarter 2006	Production of condensate from Point Thomson is expected to commence at the end of 2006

1.6 PERMITS AND APPROVALS

Major construction and operations (land use) approvals required for the Point Thomson Gas Cycling Project are listed in Table 1-2. Permit application packages will address information needs identified by agencies during the pre-application process. The major areas of interest and associated mitigation measures to be addressed include:

- Alternatives considered and rejected for the major project components (Section 2 of this ER)
- Siting criteria for gravel facilities and pipelines
- Gravel extraction
- Pipeline system height
- Presence of infield roads
- Spill response
- Air emissions
- Visual effects (module height, flare stack, communications towers)
- Potential impacts to caribou calving, migration, and insect relief habitats

- Potential impacts to terrestrial and marine mammals, birds, and fish
- Potential impacts of dock location, construction and dredging
- Cumulative effects

Table 1-2 Permits And Approvals

AGENCY	PERMIT/APPROVAL	ACTIVITY/COMMENTS
Federal Agencies	National Environmental Protection Agency (NEPA) compliance	NEPA process required before Federal permits can be issued.
U.S. Army Corps of Engineers (USACE)	Section 404/10	Onshore pad and road construction, mine site development, and offshore dock construction/dredging.
Environmental Protection Agency (EPA)	National Pollution Discharge Elimination System (NPDES) General Permit	Plan to use General Permit for camp waste (NPDES Permit AKG-31-0000).
EPA	NPDES General Stormwater/Industrial Activity	Stormwater drainage during onshore construction and operations (new North Slope permit or multi-sector general permit).
EPA	Class I Disposal Well	Injection of Class I wastes.
USACE/ EPA	Ocean Dumping Permit (Section 103 of Marine Protection, Research, and Sanctuaries Act)	Assuming dredging is necessary to access dock. Maintenance dredging.
National Marine Fisheries Service (NMFS)	Incidental Harassment of Marine Mammals (whale and seal)	Construction and operation.
NMFS	Endangered Species Act (ESA) Section 7 Consult for Bowhead whales	Construction and operation.
U.S. Fish and Wildlife Service (USFWS)	ESA, Section 7 Consult for Spectacled Eider and Steller's Eider	Construction and operation.
USFWS	Letter of Authorization for Incidental Take of Marine Mammals (polar bear and walrus)	Construction and operation.
U.S. Coast Guard & EPA	Oil Spill Contingency Plan	Construction, drilling, and operation.
Alaska Department of Natural Resources, (ADNR) State Pipeline Coordinator's Office	Pipeline Right-of-Way Lease	Pipeline construction and operations in State waters and lands.
ADNR, Division of Oil and Gas	Unit Plan of Operations approval	Required for development activity within the Unit.
ADNR, Division of Land	Material Sales Contract	Gravel mining and purchase.
ADNR, Division of Land	Miscellaneous Land Use (ice roads on and off shore)	Construction and operations of lease.
ADNR, Division of Mining and Water	Water Use/ Water Rights	Consumptive use for ice road, construction, domestic, and drilling.
Alaska Department of Environmental Conservation (ADEC)	Oil Discharge Prevention and Contingency Plan	Drilling and operations.

Table 1-2 (Cont.) Permits And Approvals

AGENCY	PERMIT/APPROVAL	ACTIVITY/COMMENTS
ADEC	Air Quality Permit to Construct	Construction, drilling, and operations.
ADEC	Title V Air Permit to Operate	Drilling and operations.
ADEC	Section 401 water quality certification /water quality variance for dock construction	All construction under Corps 404 permit (certification of permit).
ADEC	Waste Water Disposal Permit	Construction and operations.
ADEC	Temp Drilling/ Waste Storage/Solid Waste Disposal Facility (G&I)	Drilling.
Alaska Department of Fish and Game	Title 16 Fish Habitat	Mine site development and stream crossings.
Alaska Division of Governmental Coordination	Coastal Zone Consistency Determination	Construction and operations (certification of all Federal and State permits).
Alaska Oil and Gas Conservation Commission	Underground Injection Certification	Permit for Class II injection well.
North Slope Borough	Rezoning – Conservation District to Resource Development District and Submission of Master Plan for approval	Point Thomson Unit has been rezoned as a resource development district. However, a portion of the pipeline route to Badami will require rezoning. A master plan for the Point Thomson Unit could be required.

1.7 SCOPE OF PROJECT DESCRIPTION AND ENVIRONMENTAL ASSESSMENT

This ER is designed to provide the necessary information to support agency decision-making for permits listed in Table 1-2. Alternative project components of the proposed action are analyzed in Section 2 of this ER as a basis for alternatives evaluation required by the National Environmental Policy Act (NEPA 40 Code of Federal Regulations [CFR] 1502.14), regulations of the U.S. Army Corps of Engineers (USACE 33 CFR 325-Appendix B), and EPA 404(b)(1) Guidelines (40 CFR 230). Major project components and activities that constitute the preferred alternative are described in Section 3. Sections 4 and 5 (Affected Environment and Environmental Consequences) are intended to provide information to assist in satisfying NEPA requirements at 33 CFR Part 230.34. Mitigation measures incorporated into the project design are detailed in Section 6, which is intended to establish the basis for regulatory review for conformance with the requirements of Section 404(b)(1) Guidelines and for other permit decision-making. Section 7 considers the cumulative effects of the Point Thomson Gas Cycling Project in combination with external actions within the project area. Section 8 provides a list of literature cited.

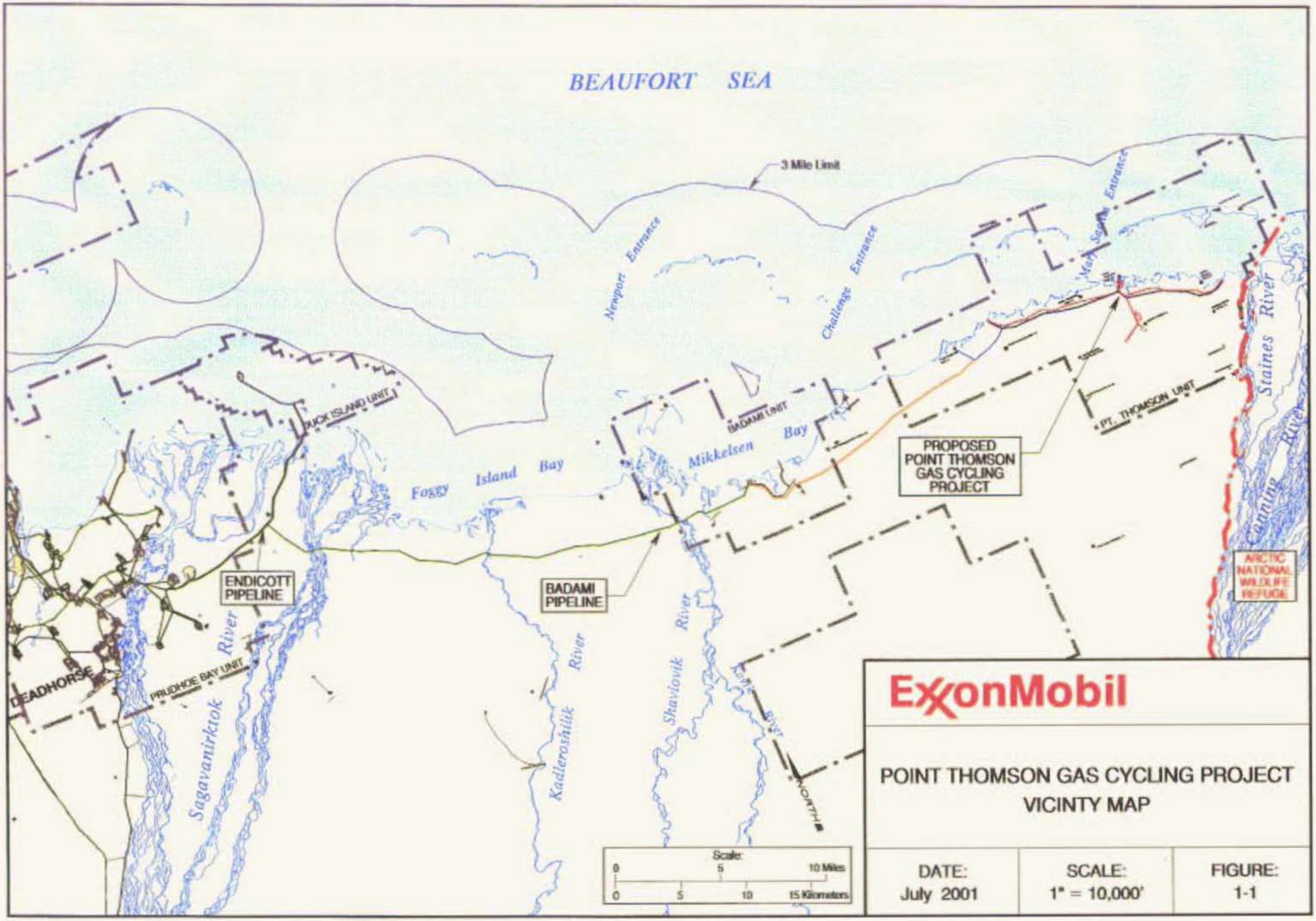

BEAUFORT SEA
3 Mile Limit
Newport Entrance
Challenge Entrance
Mary Sachs Entrance
DUCK ISLAND UNIT
BADAMI UNIT
PT. THOMSON UNIT
PRUDHOE BAY UNIT
Foggy Island Bay
Mikkelsen Bay
PROPOSED POINT THOMSON GAS CYCLING PROJECT
ENDICOTT PIPELINE
BADAMI PIPELINE
DEADHORSE
Sagavanirktok River
Kadleroshilik River
Shaviovik River
Staines River
Canning River
ARCTIC NATIONAL WILDLIFE REFUGE
NORTH
Scale:
0 5 10 Miles
0 5 10 15 Kilometers
ExxonMobil
POINT THOMSON GAS CYCLING PROJECT
VICINTY MAP
DATE:
July 2001
SCALE:
1" = 10,000'
FIGURE:
1-1

Fig1 1.dgn

2.0 ANALYSIS OF DEVELOPMENT COMPONENTS

The purpose of this section is to describe the evaluation of potential development component options for the proposed Point Thomson Gas Cycling Project. Project component categories discussed in this section are as follows:

- Field Development
- Construction Camp Facilities
- Permanent Camp Facilities
- Power Facilities
- Drilling Waste Management
- Marine Dock
- Airstrip
- Roadless Development
- Pipeline Mode
- Gravel Mine
- Gravel Reuse

An initial analysis was conducted to determine if component category options met basic project requirements. Options that did not meet basic project needs were not retained for further consideration. A detailed analysis of options retained for further consideration was conducted to evaluate technical, logistical, and potential environmental considerations. Estimated costs were not considered as part of these analyses. Descriptions of component category options considered and the results of the analyses are discussed and presented in tabular form in the following sub-sections.

2.1 LOCATION OF FIELD DEVELOPMENT

Gravel pads will be constructed to provide foundations for wells and facilities. Pads will be located to provide optimal positioning of facilities with respect to both environmental and gas reservoir target considerations. The Point Thomson Sands gas reservoir is located both onshore and offshore of Lions Lagoon (Figure 2-1).

Various options were evaluated for potential field development locations. Descriptions of the field development options considered and the results of the analyses are discussed and presented in tabular form in the following sub-sections.

2.1.1 Field Development Options

Three field development (FD) options were identified:

FD-1. Drilling/well pad(s) on existing natural offshore barrier islands (e.g., Flaxman, Alaska, and Challenge Islands) with facility pad(s) onshore.

FD-2. Drilling/well pad(s) on offshore man-made gravel island(s) in Lions Lagoon with facility pad(s) onshore. Two or three gravel islands would be necessary to reach a majority of the field.

FD-3. Drilling/well and facility pad(s) onshore.

2.1.2 Analysis of Field Development Options

An initial analysis determined that two of the three options would be able to access a large portion of the Point Thomson Sands gas reservoir using extended reach drilling (ERD) technology (Table 2-1). Option FD-1 was rejected because the barrier islands are not optimally located to reduce average well length. If Flaxman Island were used, at least one additional western on/offshore well pad would be required to develop the reservoir. It was determined that, based on the reservoir geography, shoreline locations are in a better position than Flaxman Island to tap the east end of the reservoir, and gravel islands would provide better positioning than Alaska and Challenge Islands, to the west. Additionally, the prospective environmental impacts of this option are of greater concern due to the known waterfowl nesting and polar bear habitat on Flaxman Island. There is also increased potential for disturbance of marine mammal habitat offshore of the barrier islands.

Options FD-2 and 3 were retained for further consideration. A detailed analysis compared the technical, logistical, and environmental considerations for each of these options. The analysis of each option is presented below and summarized in Table 2-2.

Option FD-2: This option proposes construction of man-made gravel islands in Lions Lagoon to shorten well lengths. Because the barrier island lagoon is relatively shallow it should be possible to locate islands in 6 to 10 feet (ft) (1.8 to 3 meters [m]) of water depth. The barrier islands would provide protection from both open storms and multi-year ice. There could be three offshore pads located roughly north of the pads proposed in option FD-3, offset to the east or west as required. Alternatively, to minimize subsea high pressure piping, a central drilling/well pad could be located onshore with two drilling/well pads on gravel islands in the lagoon. In either case, subsea pipelines would be necessary to transport production fluids to an onshore central processing facility (CPF). Option FD-2 would require marine docks for open water transport of supplies and equipment to the islands and sea ice roads for periodic winter transport.

Multiple transportation modes would be needed for transport of personnel during construction and operations phases. Personnel could be flown to an onshore airstrip (i.e., the Badami airstrip or an additional airstrip could be constructed onshore near the CPF pad) and transported via boat during open water season. Once sea ice roads were constructed, personnel could be flown to the onshore airstrip and driven to the man-made gravel islands. During times of the year when neither boats nor ice roads can be used, personnel could be flown to the onshore airstrip and then to the man-made gravel islands via helicopters. A helicopter pad would be required on each man-made gravel island for emergency airlifts.

Although Option FD-2 would provide for shorter ERD well lengths due to placement of gravel islands directly above the reservoir targets, it was rejected for the following reasons:

- Subsea pipelines from the gravel island well pads would consist of multiple 3-phase (oil, water, and gas) gathering lines to the onshore CPF. Hydrate prevention, leak detection, and high 3-phase stream fluid temperature would increase the complexity of pipeline design and maintenance.

- The lagoon is a foraging and molting habitat for waterfowl nesting on Flaxman Island. Option FD-2 could have an impact on foraging activities during nesting and disrupt birds during the molting period.
- Flaxman Island has documented polar bear denning habitat. Noise associated with construction and operations within Lions Lagoon could potentially disturb denning polar bears.

Option FD-3: This option proposes that all drilling/well and production facilities are located onshore. The target reservoir would be accessed using ERD, which has a 20,000-ft (6,096-m) reach capability. The ERD helps to minimize the number of pads required and reach downhole objectives offshore. Option FD-3 places the pads close to the shoreline in order to maintain the ability to reach out, under the lagoon, to the more prolific portions of the reservoir. All gathering and export pipelines would also be constructed onshore (see Section 2.4 for pipeline analysis). The number of marine docks is reduced under this option, since no island docks would be required. One marine dock is proposed for open water transport of modules, equipment, and supplies (see Section 2.4.1 for marine dock analysis). This option eliminates complicated multiple transportation mode requirements for year-round transport of personnel by constructing an inland airstrip and infield gravel roads between pads (see Sections 2.3.2 and 2.3.3 for airstrip and infield road analyses, respectively). Option FD-3 could reduce potential impacts on waterfowl and polar bears compared to Option FD-2. Option FD-3 is the preferred option for the Point Thomson field development. Section 3.0 presents further details regarding the proposed Point Thomson facility placement and Section 5 discusses the potential environmental consequences.

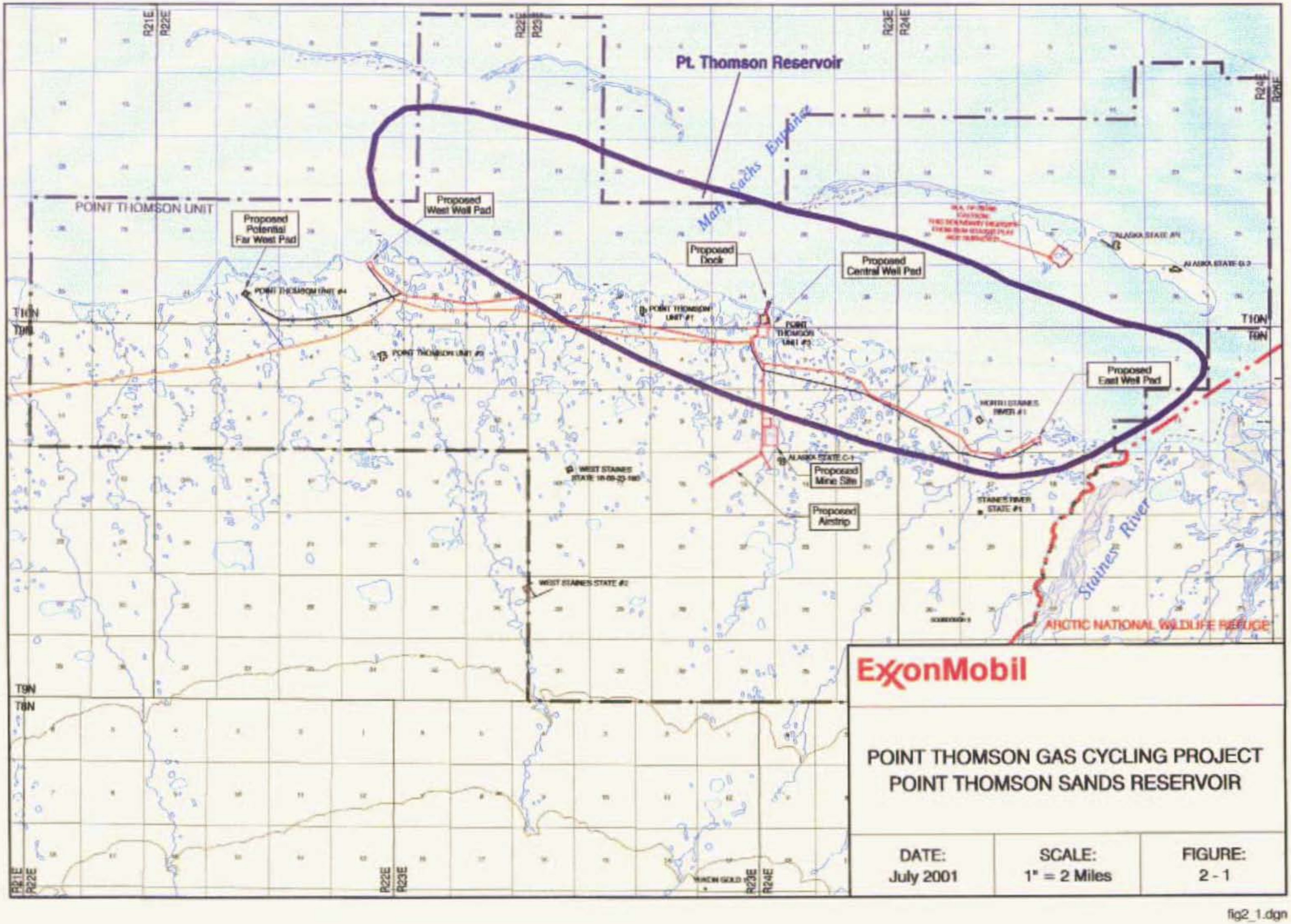
Table 2-1 Initial Analysis of Field Development Options

FIELD DEVELOPMENT OPTIONS	ADEQUATE ERD ACCESS TO POINT THOMSON RESERVOIR TARGETS	RETAIN? [YES/NO]
FD-1. Drilling/well pad(s) on existing natural offshore barrier islands with facility pad(s) onshore	No	No
FD-2. Drilling/well pads on offshore man-made gravel islands in Lions Lagoon with facility pad(s) onshore	Yes	Yes
FD-3. Drilling/well and facility pad(s) onshore	Yes	Yes

ERD = extended reach drilling

Table 2-2 Detailed Analysis of Field Development Options

RETAINED FACILITY DEVELOPMENT OPTIONS	CONSIDERATIONS			STATUS
	TECHNICAL	LOGISTICAL	POTENTIAL ENVIRONMENTAL	
FD-2. Drilling/well pads on 2 or 3 offshore man-made gravel islands in Lions Lagoon with facility pad(s) onshore	• 2-3 Gravel islands • Subsea pipelines/ onshore processing • Multiple docks for open water season support • Ice roads for periodic winter support • Onshore airstrip • Multiple helicopter pads	Multiple transportation mode requirements for year-round transport.	<u>Wildlife</u>: Bird foraging and molting habitat Polar bear denning habitat <u>Marine habitat</u>: 2-3 Gravel islands Multiple gravel docks <u>Tundra</u>: Gravel pad(s)	Rejected
FD-3. Drilling/well and facility pad(s) onshore	• Onshore processing and pipeline • A dock for open water season support • Ice road for periodic winter support • Airstrip	Gravel roads between CPF and well pads for year round all weather access.	<u>Wildlife</u>: Minimal, mostly during construction <u>Marine habitat</u>: Gravel dock <u>Tundra</u>: Gravel pads	Preferred



ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
POINT THOMSON SANDS RESERVOIR

DATE:	SCALE:	FIGURE:
July 2001	1" = 2 Miles	2 - 1

fig2_1.dgn

2.2 SUPPORT FACILITIES

This section analyzes the potential use of Badami support facilities versus installation of new comparable facilities at Point Thomson. Analyses focus on camp, power, and waste management facilities.

2.2.1 Camp Facilities

Standard Arctic drilling and construction procedures include the establishment of an interim camp to house personnel during the construction/drilling phase(s) of a project and a smaller permanent camp for operations personnel. Interim camp facilities are typically sold and moved off-site when drilling and construction has been completed and a development moves into the operations phase.

Various combinations of potential construction and permanent camp facility options were evaluated. Descriptions of the camp facility options considered and the results of the analyses are discussed and presented in tabular form in the following sub-sections.

2.2.1.1 Construction Camp Facility Options

Due to the remoteness of Pt. Thomson from the established Prudhoe Bay facilities, two construction camp facility (CCF) options were considered:

CCF-1. House Point Thomson construction personnel at Badami 250-person construction camp and expand existing construction camp to 450-person capacity.

CCF-2. Transport a 450-person construction camp to Point Thomson.

2.2.1.2 Analysis of Construction Camp Facility Options

A 250-person capacity construction camp is currently being stored at the Badami facility. It is anticipated that the proposed Point Thomson Gas Cycling Project will require a 75-person capacity construction camp, building up in stages to the projected peak requirement of up to 450 persons.

Construction personnel could possibly be housed at Badami. However, travel between Badami and Point Thomson from break-up to freeze-up is problematic. Once ice road travel ceases, personnel could be transported via air from Badami to Point Thomson. During open-water season personnel could be transported via "crew boats" to and from Point Thomson. When freeze-up commences in fall, personnel transport would have to shift back to air until ice roads could be built. Another option for transport of personnel between Badami and Point Thomson would be to build a gravel road between the facilities.

An initial analysis determined that Option CCF-1 would not meet the needs of the proposed project (Table 2-3). A detailed analysis was not conducted for construction camp facility options. A summary of each option is presented below.

Option CCF-1: The construction camp at Badami is not owned by the facility operator (BP Exploration-Alaska), and is only being stored there until it can be moved to another location. However, the construction camp could be leased in place. Lease costs for this construction camp would be comparable with lease costs associated with locating a construction camp at Point

Thomson. The 250-person construction camp at Badami would need to be expanded to house up to 450 people.

Option CCF-1 was rejected for the following reasons:

- Constant transfer of personnel is an inefficient use of hours-per-person day.
- An emergency shelter would need to be constructed at Point Thomson to accommodate all personnel in case travel to Badami is prohibited due to poor weather conditions.
- A gravel road between Badami and Point Thomson would increase the footprint of the proposed project and impact additional habitat due to placement of approximately 20 miles (mi) (32 kilometers [km]) of gravel road over the tundra.
- Transportation of personnel via air, water, or ice road would create additional traffic noise and air emissions.

Option CCF-2: Under this option a self-contained construction camp with up to a 450-person capacity could be leased from the existing North Slope inventory of older construction camps or a new camp may be purchased and transferred to Point Thomson. This option eliminates complicated multiple transportation mode requirements associated with Option CCF-1. Construction personnel will access the proposed project site via sea ice road during the first winter construction phase. Construction of an inland airstrip will facilitate movement of personnel to the project site for the remaining construction phases and during operations (see Sections 2.3.2 for airstrip analysis). The preferred option for Point Thomson construction camp is Option CCF-2. Section 3.10.3 of this document presents details regarding the Point Thomson construction camp.

2.2.1.3 Permanent Camp Facility Options

Two permanent camp facility (PCF) options were identified:

PCF-1. Expand Badami's permanent camp from 20 rooms to a capacity of up to 90 people.

PCF-2. Construct a permanent camp with the capacity to hold 75 to 90 people at Point Thomson.

2.2.1.4 Analysis of Permanent Camp Facility Options

Operations and maintenance personnel could possibly be housed at Badami. However, travel between Badami and Point Thomson from break-up to freeze-up would be have the same logistic problems discussed above for the construction camp. The Badami permanent camp has 20 rooms, with 15 being occupied by operations personnel on a continuous basis. The Point Thomson Gas Cycling Project will likely require a permanent camp with a capacity to house 30 people for general operations and up to 75 to 90 people during special work programs (e.g., planned and emergency maintenance operations and workovers).

An initial analysis determined that Option PCF-1 would not meet the needs of the proposed project (Table 2-3). A detailed analysis was not conducted for permanent camp facility options. A summary of each option is presented below.

Table 2-3 Initial Analysis of Camp Facility Options

CAMP FACILITY OPTIONS	MEETS CONSTRUCTION NEEDS		MEETS OPERATIONS NEEDS		RETAIN? [YES/NO]
	WINTER	SUMMER	WINTER	SUMMER	
Construction Camp Facility Options					
CCF-1. House Point Thomson construction personnel at Badami 250-person construction camp and expand existing construction camp to a 450-person capacity.	No	No	N/A	N/A	No
CCF-2. Transport a 450-person construction camp to Point Thomson.	Yes	Yes	N/A	N/A	Yes
Permanent Camp Facility Options					
PCF-1. Expand Badami's permanent camp from 20 rooms to a capacity of up to 90 people.	N/A	N/A	No	No	No
PCF-2. Construct a permanent camp with the capacity to hold 75 to 90 people at Point Thomson.	N/A	N/A	Yes	Yes	Yes

N/A = not applicable

Option PCF-1: The Badami development is a minimal facility. To date no provisions have been made to accommodate expansion of the facility. The existing gravel pad would need to be enlarged to allow expansion of the permanent camp. A 70-room addition with associated infrastructure (e.g., kitchen, restrooms, showers, et cetera) would need to be purchased and installed at Badami to support Point Thomson permanent camp requirements.

Option PCF-1 was rejected for the following reasons:

- Constant transfer of personnel is an inefficient use of hours-per-person day.
- A gravel road between Badami and Point Thomson would increase the footprint of the proposed project and impact additional habitat due to placement of approximately 20 mi (32 km) of gravel road over the tundra.
- An emergency shelter would need to be constructed at Point Thomson to accommodate all personnel in case travel to Badami is prohibited due to poor weather conditions.
- Transportation of personnel via air, water, or ice road would create additional traffic noise and air emissions that could potentially disturb wildlife in the area.

Option PCF-2: Under this option a permanent camp with a capacity of 75 to 90 people would be purchased and transported to Point Thomson for installation. This option eliminates complicated multiple transportation mode requirements associated with Option PCF-1. Construction of an inland airstrip will facilitate movement of personnel to the project site for the operations phase (see Sections 2.3.2 for airstrip analysis). The preferred option for Point Thomson construction camp is Option PCF-2. Section 3.13.1 of this document for presents further details regarding the Point Thomson permanent camp

2.2.2 Power Facilities

Electrical power is generated on-site at remote North Slope developments. Diesel powered electrical generators are typically the initial power source used for drilling and during construction of facilities. Once wells are drilled, natural gas from the wells can be used to power on-site electrical generators and diesel generators are phased out as the primary power source.

Potential power facility options were evaluated for the proposed project. Descriptions of the power facility options considered and the results of the analyses are discussed and presented in tabular form in the following sub-sections.

2.2.2.1 Power Facility Options

Two power facility (PF) options were identified:

PF-1. Utilize Badami spare capacity with additional power generation units installed either at Badami or Point Thomson.

PF-2. Install power generation units at Point Thomson.

2.2.2.2 Analysis of Power Facility Options

The Badami facility has two 9.0-megawatt (MW) [918,000 kilogram-meters/second (kg-m/s)] power generation units. These two units are currently generating 6 to 6.5 MW (612,000 to 663,000 kg-m/s) for Badami power requirements, with a spare capacity of 2.5 MW (255,000 kg-m/s). The power requirements of the Point Thomson Gas Cycling project are estimated to be 10 MW (1,020,000 kg-m/s).

An initial analysis determined that Option PF-1 would not meet the needs of the proposed project (Table 2-4). A detailed analysis was not conducted for power facility options. A summary of each option is presented below.

Option PF-1: The current Badami power facility has a spare capacity of 2.5 MW (255,000 kg-m/s). Additional power generation units would be necessary at Badami or Point Thomson to make up the shortfall in power generation capacity. In order to utilize the spare power capacity at Badami, a powerline would have to be constructed between Badami and Point Thomson.

Option PF-1 was rejected for the following reason:

- The minimal spare capacity from the Badami power facility does not justify the installation and maintenance of a powerline to satisfy Point Thomson project requirements.
- Installation of an above-ground powerline would require year-round access for maintenance purposes. A gravel road between Badami and Point Thomson would increase the footprint of the proposed project and potentially impact sensitive tundra habitat due to placement of approximately 20 mi (32 km) of gravel road.
- A buried power line would not require regular maintenance or a gravel road; but disturbance of the tundra for excavation and burial of the power lines would occur.

Option PF-2: Under this option power generation units would be installed at Point Thomson to supply the project needs. This option eliminates the need to install a powerline from Badami to Point Thomson. Powerlines to pads and the airstrip would be buried in infield gravel roads (see Section 2.3.3 for infield road analysis). The preferred option for Point Thomson power facility is Option PF-2. Section 3.13.3 of this document for presents further details regarding Point Thomson power generation equipment.

Table 2-4 Initial Analysis of Power Facility Options

POWER FACILITY OPTIONS	MEETS CONSTRUCTION NEEDS		MEETS OPERATIONS NEEDS		RETAIN? [YES/NO]
	WINTER	SUMMER	WINTER	SUMMER	
PF-1. Utilize Badami capacity with additional power generation units installed either at Badami or Point Thomson.	Yes	Yes	Yes	Yes	No
PF-2. Install power generation units at Point Thomson.	Yes	Yes	Yes	Yes	Yes

2.2.3 Drilling Waste Management

The Point Thomson Gas Cycling facility is designed to be a zero drilling waste discharge facility. A grind and inject (G&I) facility and Class I disposal well are critical components of a zero drilling waste discharge facility.

Drilling waste management options were evaluated for the proposed project. Descriptions of the drilling waste management options considered and the results of the analyses are discussed and presented in tabular form in the following sub-sections.

2.2.3.1 Drilling Waste Management Options

Two drilling waste management (DWM) options were identified:

DWM-1. Use Badami G&I facility and Class I disposal well for disposal of Point Thomson drilling waste.

DWM-2. Installation of a G&I facility and Class I disposal wells at Point Thomson.

2.2.3.2 Analysis of Drilling Waste Management Options

An initial analysis determined that Option DWM-1 would not meet the needs of the proposed project (Table 2-5). A detailed analysis was not conducted for drilling waste management options. A summary of each option is presented below.

Table 2-5 Initial Analysis of Drilling Waste Management

DRILLING WASTE MANAGEMENT OPTIONS	FACILITY NEEDS		RETAIN? [YES/NO?]
	CONSTRUCTION	LONG-TERM	
DWM-1. Use Badami grind & inject facility and Class I disposal well for disposal of Point Thomson drilling waste.	No	No	No
DWM-2. Installation of a grind & inject facility and Class I disposal wells at Point Thomson.	Yes	Yes	Yes

Option DWM-1: Badami currently has a G&I facility and a Class I disposal well. Badami facilities may have the capacity to handle waste generated from the proposed Point Thomson project. Drilling wastes could be trucked from Point Thomson to Badami on a sea ice road since drilling is anticipated during the winter.

Option DWM-1 was rejected for the following reasons.

- Produced water and camp greywater can be injected into a Class I disposal well. Disposal of these fluids from Point Thomson would require either building a long pipeline to transport these fluids to Badami or drilling a Class II well at Point Thomson.
- Unless a gravel road was constructed between Badami and Point Thomson, the Badami facilities could not be accessed via truck during periods of the year when ice roads are unavailable.
- Trucking drilling waste to Badami would cause increased vehicular traffic and associated noise and air emissions.
- Should a vehicular accident occur, drilling wastes could be spilled on the tundra.

Option DWM-2: Under this option a G&I facility and Class I disposal well(s) would be installed at the proposed project site. This option eliminates the need to truck wastes off-site. The preferred option for Point Thomson drilling waste management is Option WM-2. Section 3.12 of this document presents a discussion of all types of wastes that will be generated and procedures for their disposal.

2.3 FACILITY ACCESS

Project transportation needs include the ability to transport personnel, supplies, and equipment to and from Point Thomson during drilling, construction and operation phases. The closest existing access facilities are located at Badami, approximately 20 mi (32 km) west of the proposed CPF pad. To provide year round access to these facilities, a gravel road from Point Thomson to Badami would be required. During the conceptual and preliminary planning processes, several alternatives were identified for accessing Point Thomson facilities. The following sub-sections describe the basic features and analysis of facility access alternatives.

2.3.1 Marine Dock

Due to the remote location of the proposed Point Thomson Gas Cycling site, marine access is required for movement of large facility modules, drill rigs, and seasonal equipment and bulk supply deliveries. Barges and other boats can usually travel from the Prudhoe Bay to the Point Thomson area between mid-July at the earliest to mid September (but may be stopped earlier to avoid September whaling conflicts). Sea barges are typically used to transport large modules and other supplies and equipment from the Lower-48 or southcentral Alaska. Air transport is not a realistic option due to the size and weight of these items. Rail and road are not practical due to the remoteness of the site, length of rail/roadway required, and the obvious associated habitat impacts.

The weight of a barge load determines the barge draft. In turn, the draft requirements of anticipated barge loads determine the dock length needed to reach the required depth of water. Although barge loads and associated draft requirements have not been finalized for the proposed Point Thomson Gas Cycling Project, preliminary analyses were conducted to evaluate potential marine access options for the proposed project. A 9-ft (3-m) draft requirement was chosen for initial design purposes. Available bathymetry data was used in the initial design considerations. Descriptions of the dock options considered and the results of the analyses are discussed and presented in tabular form in the following sub-sections.

2.3.1.1 Marine Dock Design Options

Five marine dock (MD) options were identified.

MD-1. Modification of the current Badami dock to accommodate a maximum barge load of 6,000 tons (5,443 metric tons) and 9-ft (3-m) draft requirement.

MD-2. Construction of a gravel backfill dock at Point Thomson to accommodate a maximum barge load of 6,000 tons (5,443 metric tons) and 9-ft (3-m) draft requirement with the dockhead at 9-ft (3-m) of water.

MD-3. Construction of a gravel backfill dock at Point Thomson to accommodate a maximum barge load of 6,000 tons (5,443 metric tons) and 9-ft (3-m) draft requirement with dockhead at 7-ft (2-m) of water and sunken barges extending out to 9-ft (3-m) of water during module transportation.

MD-4. Construction of a gravel fill dock incorporating Point Thomson spit to accommodate a maximum barge load of 6,000 tons (5,443 metric tons) and 9-ft (3-m) draft requirement with dockhead at 7-ft (2-m) of water with dredging to 9-ft (3-m) of water for module transportation.

MD-5. Construction of a gravel backfill dock at Point Thomson to accommodate a maximum barge load of 6,000 tons (5,443 metric tons) and 9-ft (3-m) draft requirement with dockhead at 7-ft (2-m) of water and dredging to 9-ft (3-m) of water for module transportation.

2.3.1.2 Analysis of Marine Dock Design Options

An initial analysis rejected two of the five marine dock options (Table 2-6), Options MD-1 and MD-4, from further consideration. A summary of each option is presented below.

Option MD-1: The existing dock at the Badami facility was designed to handle barges and modules in the 1,000-ton (907-metric ton) range. The existing Badami dock would be modified to accommodate a maximum barge load of 6,000 tons (5,443 metric tons) and an associated 9-ft (3-m) draft requirement. Dock modifications would require either placing additional gravel fill or dredging to provide a sufficient water depth to land heavier modules. The dock width would also have to be increased to accommodate the heavier modules. A 35-acre (141,600-m^2) gravel reserve area, located adjacent to the northwest end of the Badami mine site impoundment, currently used as a fresh water source for the Badami facility, was identified for future use during Badami planning. This gravel reserve area would need to be developed to supply gravel for any Badami dock modifications.

Additional staging and/or storage area(s) would need to be constructed at the Badami facility to handle Point Thomson modules, equipment, and other supplies, and any containerized solid waste for back-haul shipping. Transport to and from the Badami dock to Point Thomson could take place via an annual winter sea ice road or a permanent gravel road.

Option MD-1 was rejected for the following reasons.

- Modules and other equipment/supplies could be landed and staged at a modified Badami dock during open water season. Theoretically, an ice road could then be constructed in the winter and the modules and equipment/supplies transported to Point Thomson. Transport of typical oil and gas equipment via ice road is not anticipated to pose any problems. However, to date, the largest modules to be transported over ice roads on the North Slope weighed approximately 1,300 tons (1,179 metric tons). The transport of 6,000 ton (5,443 metric ton) modules via ice roads could require the development of new technology in order to assure the safe transport of the heavy modules. In addition, the Point Thomson area has limited freshwater resources for ice road construction.
- A gravel road would need to be a minimum of 50-ft (150-m) at crown width to support the 6,000 ton (5,443 metric ton) modules. A gravel road of this size between Badami and Point Thomson would greatly increase the footprint of the proposed project and increase impacts to habitat along the approximately 20-mi (32 km) route.

Option MD-4: Under Option MD-4, a gravel fill dock would be built at Point Thomson incorporating the existing spit and Point Thomson at the end of the spit. The spit would serve as a road from the marine dock located at Point Thomson. Altogether, an estimated 750,000 cubic yards (cy) (573,420 cubic meters [m^3]) of gravel would be needed. The spit, assumed to have an average elevation of 2-ft (0.6 m) above mean sea level, would be expanded to 11-ft (3-m) above mean sea level with a crown width of 50-ft (15-m) and a 5 horizontal to 1 vertical slope. The existing spit is approximately 9,000-ft (2,743-m) in length. A 2,000-ft (610-m) long by 100-ft (30-m) dock would be built off the northwest end of Point Thomson to reach 7-ft (2-m) of water at the dockhead. A 500-ft (152-m) long channel would need to be dredged to reach 9-ft (3-m) of water.

Option MD-4 was rejected for the following reasons:

- Point Thomson and its associated spit fluctuate between being connected and having a breech near the point itself. Currently the spit and Point Thomson are not connected. This indicates the area is subject to erosion due to strong storms and currents entering the lagoon via Mary Sachs Entrance.
- Considerably more gravel (roughly 7.5 times more than that required for Option MD-5) would be needed to build the dock and associated road proposed under this option. It is assumed that more than one gravel source would need to be developed.
- Enlarging the spit width could potentially impact fish habitat. A 1999 fish study conducted in Lions Lagoon found more fish varieties than had been expected at a station on the southwest side of the spit (LGL 2000).
- The road leading around the lagoon to the CPF would cross through sensitive salt marsh habitat.

Options MD-2, MD-3, and MD-5 were retained for further consideration. A detailed analysis compared the technical, logistical, and environmental considerations for each of these options (Table 2-7). A summary of each option is presented below.

Option MD-2: Under Option MD-2, a 1,750-ft (533-m) long x 100-ft (30-m) wide gravel fill dock would be built at Point Thomson near the proposed Central Well Pad (CWP). The permanent dockhead would be at 9-ft (3-m) of water.

Option MD-2 was rejected for the following reason.

- It is anticipated that there will be only a one time requirement for 9-ft (3-m) of water for off loading the 6,000 ton (5,443 metric ton) modules. Access to 9-ft (3-m) of water should not be necessary for long term operations. The need for gravel fill to build the extra 1,000-ft (305-m) of dock length to reach 9-ft (3-m) of water could be avoided.

Option MD-3: Under Option MD-3, a 750-ft (229-m) long x 100-ft (30-m) wide gravel fill dock would be built at Point Thomson near the proposed CWP. The permanent dockhead would be at 7-ft (2-m) of water. Two 400-ft (122-m) long by 100-ft (30-m) wide barges would be grounded end-to-end off the end of the dockhead and anchored with dolphins. A one-time seabed shaping and preparation operation would be necessary to properly ground the barges. After the 6,000-ton (5,443 metric ton) modules are unloaded at Point Thomson, the grounded barges would be re-floated and towed away.

Geotechnical analyses of sediments in the proposed dock area may be required to confirm sufficient substrate stability to provide adequate grounding of the barges to ensure barge stationary when loading the 6,000-ton (5,443 metric ton) modules. Option MD-3 is reserved as a possible alternative if dredging in Option MD-5 is not permitted or otherwise found to be less desirable.

Table 2-6 Initial Analysis of Marine Dock Design Options

MARINE DOCK DESIGN OPTIONS	CONSTRUCTION TRANSPORT NEEDS		LONG-TERM TRANSPORT NEEDS		RETAIN? [YES/NO]
	MODULES & DRILL RIGS	SUPPLIES & EQUIPMENT	WASTE HANDLING	SUPPLIES & EQUIPMENT	
MD-1. Modification of the current Badami dock to accommodate a maximum barge load of 6,000 tons and 9-ft (3 m) draft requirement.	Undetermined	Yes	Yes	Yes	No
MD-2. Construction of a gravel backfill dock at Point Thomson to accommodate a maximum barge load of 6,000 tons and 9-ft draft requirement with the dockhead at 9-ft of water.	Yes	Yes	Yes	Yes	Yes
MD-3. Construction of a gravel backfill dock at Point Thomson to accommodate a maximum barge load of 6,000 tons and 9-ft draft requirement with dockhead at 7-ft (2 m) of water and sunken barges extending out to 9-ft of water during module transportation.	Yes	Yes	Yes	Yes	Yes
MD-4. Construction of a gravel fill dock incorporating Point Thomson spit to accommodate a maximum barge load of 6,000 tons and 9-ft draft requirement with dockhead at 7-ft of water with dredging to 9-ft of water for module transportation.	Yes	Yes	No	No	No
MD-5. Construction of a gravel backfill dock at Point Thomson to accommodate a maximum barge load of 6,000 tons and 9-ft draft requirement with dockhead at 7-ft of water and dredging to 9-ft of water for module transportation.	Yes	Yes	Yes	Yes	Yes

Table 2-7 Detailed Analysis of Marine Dock Design Options

RETAINED MARINE DOCK DESIGN OPTIONS	CONSIDERATIONS			STATUS
	TECHNICAL	LOGISTICAL	POTENTIAL ENVIRONMENTAL	
MD-2. Construction of a gravel backfill dock at Point Thomson to accommodate a maximum barge load of 6,000 tons and 9-ft (3 m) draft requirement with the dockhead at 9-ft of water.	• Construct 1,750-ft dock at Point Thomson		Marine impacts: short-term during construction	Rejected
MD-3: Construction of a gravel backfill dock at Point Thomson to accommodate a maximum barge load of 6,000 tons and 9-ft draft requirement with dockhead at 7-ft (2 m) of water and sunken barges extending out to 9-ft of water during module transportation.	• Construct 750-ft dock at Point Thomson • One time seabed shaping • Ground/anchor two 400-ft long barges end to end.	• Transport barges to Point Thomson • Re-float and tow barges away after module unloading	Marine impacts: short-term during construction and barge grounding and re-floating	Reserved
MD-5. Construction of a gravel backfill dock at Point Thomson to accommodate a maximum barge load of 6,000 tons and 9-ft draft requirement with dockhead at 7-ft of water and dredging to 9-ft of water for module transportation.	• Construct 750-ft dock at Point Thomson • One time dredging of a 1,000-ft long x 400-ft wide x 2-ft deep channel	• Transport suction dredge to Prudhoe Bay via Dalton Highway and transport to Point Thomson via barge • Disposal of dredge spoils	Marine impacts: short-term during construction and dredging	Preferred

Option MD-5: Under Option MD-5, a 750-ft (229-m) long x 100-ft (30-m) wide gravel fill dock, utilizing approximately 100,000 cy (76,400 m^3) of gravel, would be built at Point Thomson near the proposed CWP. The permanent dockhead would be at 7-ft (2 m) of water. A one time dredging activity would clear a 1,000-ft (305-m) long by 400-ft (122-m) wide by 2-ft (0.6-m) deep channel to 9-ft (3-m) of water. This dock option would fulfill requirements for one time transport of 6,000 ton (5,443 metric ton) modules and the long term needs of the project. The preferred option for Point Thomson marine transportation needs is Option MD-5. Section 3.5 of this document presents further details regarding the proposed Point Thomson marine dock and Section 5 discusses the potential environmental consequences.

2.3.2 Airstrip

Year-round access to remote sites, such as Badami and Point Thomson, is possible with the construction of a gravel airstrip and/or helicopter-landing pad. In general, air access is best suited for movement of personnel and emergency movement of supplies or equipment. Twin Otter aircraft are typically used for crew changes. However, for maintenance and servicing of large pieces of equipment an airstrip must be large enough to provide landing and take-off capabilities for a fully loaded Hercules C-130, and be adequate for 737 emergency evacuation of personnel.

Potential airstrip options were evaluated for the proposed project. Descriptions of the airstrip options considered and the results of the analyses are presented in the following sub-sections.

2.3.2.1 Airstrip Options

Two airstrip facility (AF) options were identified:

AF-1. Expand Badami airstrip runway length and width, and upgrade navigation equipment. The current dimensions of the Badami airstrip are 5,100-ft (1,550-m) by 75-ft (23-m).

AF-2. Construct an airstrip at Point Thomson with a gravel runway 5,150-ft (1,570-m) long by 150-ft (46-m) wide.

2.3.2.2 Analysis of Airstrip Options

An initial analysis determined that Option AF-1 would not meet the needs of the proposed project (Table 2-8). A detailed analysis was not conducted. A summary of each option is presented below.

Option AF-1: Expanding the Badami airstrip runway length and width would upgrade the runway for occasional use by a 737. Runway modifications would require gravel fill to be placed. This would require development of the 35-acre (141,600-m^2) gravel reserve area located south of Badami facilities.

A gravel road to Point Thomson or multiple transportation modes would be needed for year-round transport of personnel from the Badami airstrip to Point Thomson. Heavy equipment could be transported from Prudhoe Bay to Point Thomson via boat during open-water season. Once sea ice roads were constructed, personnel and equipment could be flown to Badami and driven to Point Thomson. During times of the year when neither boats nor ice roads could be used, personnel could be flown to Badami and then transported to Point Thomson via helicopters. A helicopter pad would be required at Point Thomson for emergency airlifts. Alternatively, a gravel road could be built between Badami and Point Thomson for year-round ground transportation between the facilities.

Table 2-8 Initial Analysis of Airstrip Options

Airstrip Options	Facility Access Needs		Retain?
	Construction	Long-term	[Yes/No]
AF-1. Expand Badami airstrip length and width, and upgrade navigation equipment.	No	No	No
AF-2. Construct an airstrip at Point Thomson with a gravel runway 5150-ft long by 150-ft wide.	Yes	Yes	Yes

Option AF-1 was rejected for the following reasons:

- Due its close proximity to the coastline, the Badami airstrip is subject to frequent closure due to foggy conditions. The closures could inhibit efficient and timely transport of personnel to Point Thomson.
- Multiple transportation modes for crew changes would be inefficient. From an operations point-of-view, a permanent gravel road for access between Badami and Point Thomson would be preferred over use of ice roads, boats, and helicopter transport of personnel. A gravel road between Badami and Point Thomson would increase the footprint of the proposed project and impact tundra habitat due to placement of approximately 20 mi (32 km) of gravel road.
- Use of the Badami airstrip could cause increased traffic noise and air emissions.
- Use of the Badami airstrip could cause logistic problems should it be necessary to send a large/heavy piece of equipment out for repair. During winter, an ice road could be built to move broken equipment to the Badami airstrip for transport. During open water season and if a dock was built at Point Thomson, the broken equipment could be barged to Prudhoe Bay. Broken equipment could not be moved to the Badami airstrip year-round unless there was a gravel road built between Point Thomson and Badami. Return of repaired equipment would be subject to the same logistic problems.

Option AF-2: Under this option the proposed airstrip would be located approximately 2 mi (3 km) inland to minimize potential closures due to fog conditions. The 5,150-ft (1,570-m) long (inclusive of turn-outs at each end) by 150 ft (46 m) wide will satisfy the presently forecast requirement of regular use by Twin Otters, occasional use by Hercules day or night with cross-wind conditions, and occasional use by a 737. Gravel fill placement for the proposed runway will impact less tundra than a gravel road from Badami to Point Thomson. This option eliminates the complicated multiple modes of transportation to and from the Badami airstrip required under Option AF-1. In addition, Option AF-2 would provide a more efficient and streamlined means of responding to essential broken equipment repairs. The preferred option for Point Thomson airstrip transportation needs is Option AF-2. Section 3.4 of this document presents further details regarding the Point Thomson airstrip and Section 5 discusses the environmental consequences.

2.3.3 Point Thomson Roadless Development

The National Petroleum Reserve Alaska (NPRA) Environmental Impact Statement (MMS 1998) describes "roadless" development as facilities without permanent roads constructed along pipeline alignments connecting to existing infrastructure east of the Colville River. Roadless development is a recent trend on the North Slope prompted by both environmental and economic concerns. The Badami and Alpine facilities are considered to be roadless developments, using the NPRA definition, since they are not connected by road to existing operating areas.

Despite this definition, roadless development facilities do make use of ice roads and infield gravel roads. Seasonal ice roads are used for transporting equipment and supplies between operating areas. Infield gravel roads typically connect production pads and facilities within individual fields. In addition, a gravel road could connect two remote developments to allow sharing of infrastructure and the developments under the NPRA definition.

Road development options were evaluated for the proposed project. Descriptions of the options considered and the results of the analyses are discussed and presented in tabular form in the following sub-sections.

2.3.3.1 Road Development Options

Two road development (RD) options were identified.

RD-1. Construct in-field roads at Point Thomson between the airstrip and CPF Pad; and CPF Pad and dock facility, approximately 2.5 mi (4 km) total of gravel road. Do not construct in-field roads from the East and West Well Pads to the CPF Pad.

RD-2. Construct in-field roads at Point Thomson between the airstrip and CPF Pad; CPF Pad and dock facility; and East and West Well Pads and CPF Pad, approximately 15 mi (24 km) total of gravel road.

2.3.3.2 Analysis of Roadless Development Options

An initial analysis rejected Option RD-1 from further consideration (Table 2-9). A detailed analysis was not conducted. A summary of each option is presented below.

Option RD-1: This option would limit the amount of in-field gravel roads at the proposed Point Thomson Gas Cycling Project. A gravel road from the marine dock to the CPF Pad would be built for offloading barges; and a gravel road would be built from the airstrip to the CPF Pad, approximately 2.5 mi (4 km) total of gravel road. The East and West Well Pads would be developed and accessed using sea ice roads during the winter months.

Option RD-1 was rejected for the following reasons.

- Routine operations and maintenance activities will require personnel to make several trips daily to both East and West Well Pads. Ice roads could fulfill this need in the winter. Helicopter pads could be built adjacent to the well pads for year-round access. A gravel road would then need to be constructed connecting the helicopter pad with the production pads, and a vehicle and fuel kept on site for transport from the helicopter to the pad facilities. A dedicated helicopter and pilot would need to be stationed at Point Thomson during periods when ice roads were not being used. Coastal fog conditions could prevent helicopters from flying during essential time periods. Response time in case of an emergency situation could also be hindered by coastal fog conditions during periods of the year when ice roads are not in use.

- Logistic problems could arise if a large/heavy piece of equipment from one of the well pads needed to be sent out for emergency repair. During winter, the ice road could be used to move broken equipment to the airstrip for transport. During the remainder of the year, the broken equipment would need to "slung" out using a helicopter. The same logistic problems could arise when equipment needs to be moved out to either East or West Well Pads.
- Several daily helicopter trips out to both East and West Well Pads would significantly increase noise in the area, when compared to noise produced by similar frequency of vehicle traffic.

Table 2-9 Initial Analysis of Road Development Options

Road Development Options	Infield Facility Access Needs		Retain? [Yes/No]
	Construction	Long-term	
RD-1. Construct in-field roads at Point Thomson between the airstrip and CPF Pad; and CPF Pad and dock facility, approximately 2.5 mi (4km) total of gravel road. Do not construct in-field roads from the East and West pads to the CPF Pad.	Yes	No	No
RD-2. Construct in-field roads at Point Thomson between the airstrip and CPF Pad; CPF Pad and dock facility; and East and West Well Pads and CPF Pad, approximately 15 mi (24 km) total of gravel road.	Yes	Yes	Yes

Option RD-2: Under Option RD-2 gravel roads to the East and West Well Pads would be built in addition to the gravel roads proposed in Option RD-1. The gravel road to the East Well Pad would be approximately 5.7 mi (9 km) long with one bridge crossing an unnamed stream. The gravel road to the West Well Pad would be approximately 6.6 mi (11 km) long. Construction of gravel roads to the East and West Well Pads provides year-round access for operations and maintenance activities and emergency response.

The preferred option for Point Thomson roadless development is Option RD-2. Section 3.3.3 of this document presents further details regarding the Point Thomson infield road development and Section 5 discusses the potential environmental consequences. This option provides for infield project needs without building connecting gravel roads to Badami, Prudhoe Bay, and additional developments to the west.

2.4 PIPELINE MODE

The proposed Point Thomson Gas Cycling Project would have two infield gathering pipelines and one export pipeline. Infield gathering pipelines transport 3-phase stream produced from the East and West Well Pads to the CPF Pad. The export pipeline transports condensate from the CPF Pad to Badami and ultimately the Trans Alaska Pipeline System.

Buried pipelines on the North Slope need to be operated at near permafrost temperature, approximately 32 degrees Fahrenheit (°F) (0 degrees Celsius [°C]), in order to maintain soil stability. Infield gathering pipelines will be hot, approximately 180 to 200 °F (82 to 93 °C). It is anticipated that hydrates will form in the gathering pipelines at temperatures below approximately 80 °F (27 °C). These hydrates would eventually form a solid plug, which would prevent flow through the pipeline. Therefore, the 3-phase stream from the well pads can not be chilled to allow burying the gathering pipelines. Infield gathering pipelines will be insulated and installed on elevated vertical support members (VSMs). Section 3.9 presents further details on the proposed infield gathering pipeline system.

Potential export pipeline mode options were evaluated for the proposed project. Descriptions of the export pipeline mode options considered and the results of the analyses are discussed and presented in tabular form in the following sub-sections.

2.4.1 Export Pipeline Mode Options

Seven export pipeline mode (PM) options were identified:

PM-1. Export pipeline buried in tundra (uninsulated).

PM-2. Export pipeline buried in tundra (insulated).

PM-3. Export pipeline buried in gravel road at centerline (uninsulated).

PM-4. Export pipeline buried in gravel road at centerline (insulated).

PM-5. Export pipeline buried in gravel road at shoulder (uninsulated).

PM-6. Export pipeline buried in gravel road at shoulder (insulated).

PM-7. Export Pipeline elevated on vertical support members (VSMs).

2.4.2 Analysis of Pipeline Mode Options

As stated above, buried pipelines on the North Slope need to be operated near permafrost temperature in order to be feasible. Pipelines buried in thaw stable soils could potentially be operated "hot." However, most near-surface North Slope soils in the Point Thomson area are not thaw stable. Aboveground pipelines on VSMs can be operated "hot" since their heat is dissipated to the air and does not impact permafrost.

Point Thomson export condensate will be approximately 150 °F (66 °C). The Point Thomson condensate could possibly be pumped at a reduced temperature. A buried condensate export line would require condensate to be chilled down to approximately 32 °F (0 °C). Subsequent re-heating at the Badami tie-in would also be required in order to satisfy temperature constraints on the Badami system.

External corrosion coating and cathodic protection are necessary for buried pipeline corrosion protection. Native frozen materials are often highly resistive to the flow of cathodic current. Anodes and rectifiers installed close to the pipeline surface could be tuned to provide appropriate local cathodic protection levels.

An initial analysis rejected three of the seven options from further consideration (Table 2-10). Options PM-1, PM-3, and PM-5 all incorporate the use of uninsulated buried pipeline and were rejected for the following reasons:

- Mechanical chilling of the condensate prior to movement through pipelines might be technically possible. However, mechanical cooling systems require high maintenance in order to work efficiently. Chilling systems typically use propane as a refrigerant, which would require additional fuel consumption and produce associated air emissions.

- Chilled condensate would have to be re-heated at the Badami tie-in in order to satisfy temperature constraints on the Badami system. Re-heating equipment would need to be installed at the Badami facility, increasing both associated maintenance requirements and emissions.
- Viscosity of chilled condensate would likely increase due to chilling, necessitating additional pumping horsepower and/or larger diameter pipelines or the use of drag reducing agents in the pipeline.
- The integrity of a buried uninsulated export pipeline would be threatened due to frost heaves and/or thaw settlement.

Options PM-2, PM-4, PM-6, and PM-7 were retained for further consideration. A detailed analysis compared the technical, logistical, and environmental considerations for each of these options (Table 2-11). A summary of each option is presented below.

Options PM-2, PM-4, and PM-6: These three options have the following in common:

- The buried export pipeline would be insulated and 150 °F (66 °C) condensate would be pumped to the Badami tie-in.
- There is no practical insulation available for buried pipelines that will not absorb water over long-term submersion. Water absorption degrades the thermal resistance of insulation over time. The buried export pipeline insulation would need to be augmented with a high-density polyethylene insulation (HDPE) jacket around the pipeline.
- Additional polystyrene insulation would be placed in the pipeline trench.
- External corrosion coating and cathodic protection on the pipeline would be required.

Under Option PM-2 an insulated export pipeline would be buried directly in the tundra. This option was rejected for the following reasons.

- Insulation failure is a problem when hot pipelines are buried in tundra. Insulation failure due to water saturation would create conditions that promote pipeline corrosion.
- Civil maintenance would be required for the service life of the pipeline. On-going maintenance is likely to be high due to the potential for thaw settlement, ponding, and pipeline corrosion.

Table 2-10 Initial Analysis of Export Pipeline Mode Options

Export Pipeline Mode Options	Condensate	Pipeline System Needs			Retain? [Yes/No]
	Cooling	Thaw Stable Soils	External Corrosion Coating	Cathodic Protection	
PM-1. Export pipeline buried in tundra (uninsulated).	Yes	Yes	Yes	Yes	No
PM-2. Export pipeline buried in tundra (insulated).	No	Yes	Yes	Yes	Yes
PM-3. Export pipeline buried in gravel road at centerline (uninsulated).	Yes	Yes	Yes	Yes	No
PM-4. Export pipeline buried in gravel road at centerline (insulated).	No	Yes	Yes	Yes	Yes
PM-5. Export pipeline buried in gravel road at shoulder (uninsulated).	Yes	Yes	Yes	Yes	No
PM-6. Export pipeline buried in gravel road at shoulder (insulated).	No	Yes	Yes	Yes	Yes
PM-7. Export pipeline elevated on VSMs.	No	No	No	No	Yes

VSMs = vertical support members

Table 2-11 Detailed Analysis of Export Pipeline Mode Options

Retained Export Pipeline Mode Options	Considerations			Status
	Technical	Logistical	Potential Environmental	
PM-2. Export pipeline buried in tundra (insulated).	• Cathodic protection • External corrosion coating • Leak detection system • Pipe insulation and HDPE sheath	• Single winter construction • Civil maintenance during service life • Re-excavate trench to accommodate additional pipelines	Wildlife impacts: Noise disturbance Tundra impacts: scarring; revegetation will be required thaw settlement	Rejected
PM-4. Export pipeline buried in gravel road at centerline (insulated).	• Cathodic protection • External corrosion coating • Leak detection system • Pipe insulation and HDPE sheath • Additional gravel on road and over culverts	• Build gravel road to Badami • Civil maintenance during service life • Construction and maintenance of culverts • Re-excavate to accommodate additional pipelines or for maintenance • Traffic flow interrupted during pipeline maintenance	Wildlife impacts: Noise disturbance Tundra impacts: Thaw settlement Gravel mining Gravel placement increases footprint	Rejected
PM-6. Export pipeline buried in gravel road at shoulder (insulated).	• Cathodic protection • External corrosion coating • Leak detection system • Pipe insulation and HDPE sheath • Additional gravel on road and over culverts	• Build gravel road to Badami • Civil maintenance during service life • Construction and maintenance of culverts • Re-excavate to accommodate additional pipelines or for maintenance • Traffic flow interrupted during pipeline maintenance	Wildlife impacts: Noise disturbance Tundra impacts: Thaw settlement Gravel mining Gravel placement increases footprint	Rejected
PM-7. Export pipeline elevated on VSMs.	• No cathodic protection (except at stream and road crossings) • No external corrosion coating • Visual leak detection	• Single winter construction • Minimal civil maintenance during service life • Relatively easy to accommodate additional pipelines	Wildlife impacts: Caribou movement Noise disturbance Tundra impacts: Minimal from VSM installation	Preferred

- Initial construction and on-going maintenance would result in tundra scarring, and potential changes to surface drainage.

Under Option PM-4 an insulated export pipeline would be buried at centerline in a gravel road running between Point Thomson and Badami. This option was rejected for the following reasons.

- Placement of approximately 20 mi (32 km) of gravel road between Badami and Point Thomson would increase the footprint of the proposed project.
- Road thickness would need to be increased to allow for adequate cover over buried pipeline. Road thickness needs to also be increased at culvert crossings to allow vertical clearance between a culvert and the buried pipeline. Increased gravel volumes for road construction could require additional gravel mining.
- Pipeline placement at centerline in the gravel road limits wheel loads and would preclude movement of heavy modules and drill rigs unless additional armoring were installed.
- Civil maintenance would be required for the service life of the pipeline. Maintenance activities requiring excavation would disrupt traffic flow.
- Reuse of pipeline route for potential future additional pipelines would require excavating a new pipeline trench in the gravel road and associated disruption of traffic.

Under Option PM-6 an insulated export pipeline would be buried in the shoulder of a gravel road running between Point Thomson and Badami. This option was rejected for the following reasons.

- Placement of approximately 20 mi (32 km) of gravel road between Badami and Point Thomson would increase the footprint of the proposed project.
- Pipeline placement in the shoulder of the gravel road outside drive lanes requires a large increase in gravel fill volume. The increase gravel volumes for shoulder construction would require additional gravel mining.
- Civil maintenance would be required for the service life of the pipeline. Maintenance activities requiring excavation would disrupt traffic flow.
- Reuse of pipeline route for potential future additional pipelines would require re-excavating pipeline trench in the gravel road.

Option PM-7: Aboveground pipelines installed on VSMs have been used on the North Slope with a high degree of success. Aboveground pipelines are easier to maintain than buried pipelines since all pipeline components are readily accessible. Monitoring for leaks and operational problems is greatly simplified. Pipelines can be installed on VSMs in the winter via ice roads; therefore, environmental impacts of construction on the tundra are minimized. The preferred option for Point Thomson pipeline mode is Option PM-7. Section 3.9 of this document presents further details regarding the proposed export pipeline system and Section 5 discusses the potential environmental consequences.

2.5 GRAVEL SOURCES

The proposed Point Thomson Gas Cycling Project includes four gravel pads, a gravel fill marine dock, a gravel airstrip, and gravel roads. Preliminary geotechnical investigations have identified two categories of gravel sources for the project: gravel mining and reuse of gravel from exploratory drilling pads in the Point Thomson area.

Potential gravel source options were evaluated for the proposed project. Descriptions of the gravel source and reuse options considered and the results of the analyses are discussed and presented in tabular form in the following sub-sections.

2.5.1 Gravel Mine Options

Five gravel mine (GM) options were identified:

GM-1. Badami gravel reserve area, adjacent to northwest end of Badami water source (former mine site).

GM-2. 2 mi (3.2 km) south of the CPF Pad, adjacent to the gravel road at the north end of the airstrip.

GM-3. ½ mi (0.8 km) west and ¾ mi (1.2 km) south of the CPF Pad.

GM-4. On a gravel bar in the floodplain of an unnamed creek 1.9 mi (3 km) west of East Well Pad.

GM-5. In an oxbow of an unnamed creek 2 mi (3.2 km) east south east of West Well Pad.

2.5.2 Analysis of Gravel Mine Options

An initial analysis rejected Options GM-1, GM-4, and GM-5 from further consideration (Table 2-12).

Option GM-1 was rejected for the following reasons:

- Gravel could be transported from Badami to Point Thomson for construction and stock-piling via a sea ice road in the winter. However, the Badami reserve gravel area is far from the proposed Point Thomson project, increasing the trucking distance.
- Utilizing a mine site at Badami would eliminate any possibility of creating a secondary fresh water source for Point Thomson. The Badami water source does not have the potential to provide a secondary fresh water source to the proposed Point Thomson project. Water supply lines would need to run to Point Thomson from Badami. Water lines laid on top of the tundra would be prone to freezing and difficult to maintain. Water lines are typically laid within a gravel road in order to provide added insulation. A gravel road could be built from Badami to Point Thomson with buried water lines. However, a gravel road between Badami and Point Thomson would increase the footprint of the proposed project due to placement of approximately 20 mi (32 km) of gravel road.

Similarly, Options GM-4 and GM-5 were rejected for the following reasons.

- The site locations are not close to the majority of the Point Thomson gravel placement areas.

- Should these sites receive enough recharge water to be considered viable fresh water sources after gravel mining is completed, access to the water source will be required. However, both sites are south of the proposed pipeline route. The sites could be accessed in winter via an ice road during the first winter construction period. Summer access would require construction of pipeline crossings and gravel roads.

Options GM-2 and GM-3 were retained for further consideration. A detailed analysis compared the technical, logistical, and environmental considerations for each of these options (Table 2-13). A summary of each option is presented below.

Option GM-2: This site is centrally located, providing for efficient hauling. The site can be accessed year-round since it is adjacent to the proposed gravel road from the airstrip to the CPF Pad. Potential water recharge of the site has not yet been determined. Option GM-2 is the preferred option for the Point Thomson gravel mine. Section 3.10.1.2 of this document presents further details regarding gravel mine development and Section 5 discusses potential environmental consequences.

Option GM-3: Option GM-3 is centrally located and would provide for efficient hauling. This option will be held in reserve. It was identified as a reserved option for the following reason.

- Potential water recharge of the site has not yet been determined. The site is south of the proposed pipeline route. Should this site prove to be a viable fresh water source, the site could be accessed in winter via an ice road during the first winter construction. Summer access would require construction of an additional ½ mi (0.8 km) gravel road and a pipeline crossing

2.5.3 Gravel Reuse Options

Nine gravel reuse (GR) options were identified:

GR-1. Point Thomson Unit #1: 1.8 mi (2.9 km) west of CPF Pad and 1,300-ft (396 m) north of West Well Pad access road.

GR-2. Point Thomson Unit #2: 1.4 mi (2.3 km) south of West Well Pad.

GR-3. Point Thomson Unit #3: 500-ft (152 m) north of CPF Pad.

GR-4. Point Thomson Unit #4: 2.6 mi (4.2 km) west of West Well Pad on the coast.

GR-5. Staines River #1: 1.8 mi (2.9 km) southwest of East Well Pad and 1 mi south of the East Well Pad access road.

GR-6. North Staines River #1: 1.6 mi (2.6 km) west of East Well Pad.

GR-7. West Staines State #1: 2.3 mi (3.7 km) west of the airstrip south turnaround.

GR-8. West Staines State #2: 3.3 mi (5.3 km) southwest of the airstrip south turnaround.

GR-9. Alaska State C-1: 1/3-mi (0.5 km) northeast of the airstrip north turnaround.

Table 2-12 Initial Analysis of Gravel Mine Options

Gravel Mine Options	Central Location	Access		Future Fresh Water Source	RETAIN? [Yes/No]
		Winter	Summer		
GM-1. Badami gravel reserve area [near current Badami water source].	No	Yes	No	No	No
GM-2. 2.0 mi (3.2 km) south of the CPF Pad, adjacent to the gravel road at the north end of the airstrip.	Yes	Yes	Yes	Undetermined	Yes
GM-3. ½ mi west and ¾ mi south of the CPF Pad.	Yes	Yes	No	Undetermined	Yes
GM-4. On a gravel bar in the flood plain of an unnamed creek 1.9-mi west of East Well Pad.	No	Yes	No	Yes	No
GM-5. In an oxbow of an unnamed creek 2 mi (3.2 km) east south east of West Well Pad	No	Yes	No	Yes	No

2.5.4 Analysis of Gravel Reuse Options

Gravel reuse was considered from nine former exploratory sites. As described here, reuse includes removing clean gravel (i.e. free of contamination and other foreign materials) from the top surface of a pad. Gravel degradation, Styrofoam insulation, and hydrocarbon contaminated gravel are three important issues connected with the reuse of gravel exploratory pads. Due to erosion and thermokarsting, gravel exploratory pads degrade into the tundra over time. Reuse of gravel that has degraded into the tundra is considered to be impracticable for the Point Thomson project needs because it would require screening to retain a limited quantity of usable gravel. However, this does not prohibit gravel removal from such sites as part of site rehabilitation.

Some exploratory pads on the North Slope were constructed using Styrofoam. Pad construction consisted of a base course of soil/gravel on the tundra, followed by a Styrofoam layer and capped with gravel. There is no inventory of which pads were built with Styrofoam. Reclaiming gravel from pads with a Styrofoam sub-layer would be difficult, since an efficient method for separating Styrofoam and gravel has not yet been devised and tested.

Gravel pads need to be screened for hydrocarbon contamination prior to reuse. Contaminated gravel must be treated before being re-used. Portable incinerators can be used to treat quantities of gravel that contain hydrocarbons.

The criteria for determining whether a pad would be considered for reuse are as follows.

- The exploratory pad is within two miles of a gravel placement area associated with Pt. Thomson project.
- The exploratory pad was not constructed using Styrofoam or similar insulation materials.
- Gravel quality is acceptable for reuse (e.g., size, foreign materials present).
- If hydrocarbon contamination is present, it can be effectively remediated for reuse prior to construction.
- Gravel reuse can be incorporated into rehabilitation plans for the sites. (i.e., If the site has a reserve pit that has already been closed by the agencies, it will be left in place with adequate gravel cover. Some reserve pits that have not been closed may need to be covered using the gravel that is on site.)

Since not much information regarding Styrofoam use, hydrocarbon contamination, and gravel quality is known, site visits will be made to definitively assess these criteria. An initial analysis rejected three of the nine gravel reuse options (GR-7, GR-8, and GR-9) from further consideration (Table 2-14).

Options GR-7 and GR-8 were rejected for the following reason.

- The locations of the sites are more than two miles from any proposed Point Thomson gravel placement areas.

Option GR-9 was rejected for the following reason.

- It is known that Styrofoam was used in the construction of the Alaska State C-1 gravel pad.

Options GR-1, GR-2, GR-3, GR-4, GR-5 and GR-6 were retained for further consideration. A detailed analysis compared the technical, logistical, and environmental considerations for each of these options (Table 2-15). A summary of each option is presented below.

Option GR-1: Point Thomson Unit #1 gravel pad is known to be in good condition and does not likely contain Styrofoam. The site location, approximately 1.8 mi (2.9 km) west of the CPF and 1,300-ft (396-m) north of the West Well Pad access road, is close to project gravel placement areas. It is estimated that the site has 14,000 cy (10,700 m^3) of reusable gravel. A short ice road could be constructed in the winter for access to the site. The option of gravel reuse at Point Thomson Unit #1 will be retained for future consideration.

Option GR-2: Point Thomson Unit #2 gravel pad is in good condition and does not likely contain Styrofoam. The site is located approximately 1.4 mi (2.25 km) south of the West Well Pad. It is estimated that the site has 19,000 cy (14,530 m^3) of reusable gravel. An ice road could be constructed in the winter for access to the site. The option of gravel reuse at Point Thomson Unit #2 will be retained for future consideration.

Option GR-3: Point Thomson Unit #3 gravel pad is in good condition and does not likely contain Styrofoam. As part of the proposed Point Thomson Gas Cycling Project, Point Thomson Unit #3 will be incorporated in situ with the CWP. Option GR-3 is the proposed option for Point Thomson exploratory pad gravel reuse. Section 3.6 of this document presents further details on the reuse of Point Thomson Unit #3 gravel pad.

Option GR-4: It has not been determined if Styrofoam was used in the construction of the gravel pad or if there is contamination on the gravel pad at Point Thomson Unit #4. However this option is being retained for potential future use. In the event that a second westward pad was built for additional access to the Point Thomson Sands gas reservoir, it is anticipated that the Point Thomson Unit #4 gravel pad could be incorporated into the well pad or reused for pad construction in another location. Section 3.6 of this document includes further information regarding a second west well pad.

Option GR-5: The Staines River #1 site is located about 1.8 mi (2.9 km) southwest of East Well Pad and 1 mi south of the East Well Pad access road. It has not been determined if Styrofoam was used in the construction of the gravel pad or if there is contamination on the gravel pad at Staines River #1. It is estimated that the site has 4,722 cy (3,610 m^3) of reusable gravel. A review of topographic maps and aerial photography indicates that the gravel pad at Staines River #1 has most likely degraded too far into the tundra for successful gravel reuse. However this option is being retained for potential future use pending a more definitive site assessment.

Option GR-6: The North Staines River #1 site is located 1.6 mi (2.6 km) west of East Well Pad. It is estimated that the site has 11,000 cy (8,410 m^3) of reusable gravel. Neither the status of gravel degradation nor whether Styrofoam and/or hydrocarbon contamination is present at the North Staines River #1 gravel pad has been determined. However this option is being retained for potential future use pending a more definitive site assessment.

Table 2-13 Detailed Analysis of Gravel Mine Options

Retained Gravel Mine Options	Considerations			Status
	Technical	Logistical	Potential Environmental	
GM-2. 2.0 mi (3.2 km) south of the CPF Pad, adjacent to the gravel road at the north end of the airstrip.	Potential as fresh water source undetermined.	Year-round access from gravel road to airstrip.	Wildlife impacts: Habitat loss Tundra impacts: overburden stripping	Preferred
GM-3. ½ mi west and ¾ mi south of the CPF Pad.	Potential as fresh water source undetermined.	Winter access via ice road Summer access requires ½ mi gravel road.	Wildlife impacts: Habitat loss Tundra impacts: overburden stripping	Reserved

Table 2-14 Initial Analysis of Gravel Reuse Site Options

Gravel Reuse Site Options	Degraded Gravel	Styrofoam Insulation	Pad Contamination	Acceptable Location	Access		Retain? [Yes/No]
					Winter	Summer	
GR-1. Point Thomson Unit #1: 1.8 mi (2.9 km) west of CPF Pad and 1,300-ft north of West Well Pad access road.	No	No	Undetermined	Yes	Yes	No	Yes
GR-2. Point Thomson Unit #2: 1.4 mi (2.25 km) south of West Well Pad.	No	No	Undetermined	Yes	Yes	No	Yes
GR-3. Point Thomson Unit #3: 500-ft (152 m) north of Central Processing Facility (CPF) Pad.	No	No	Undetermined	Yes	Yes	Yes	Yes
GR-4. Point Thomson Unit #4: 2.6 mi (4.2 km) west of West Well Pad on the coast.	No	Undetermined	Undetermined	Yes[1]	Yes	No	Yes
GR-5. Staines River #1: 1.8 mi (2.9 km) southwest of East Pad and 1 mi south of the East Well Pad access road.	Likely	Undetermined	Undetermined	Yes	Yes	No	Yes
GR-6. North Staines River #1: 1.6 mi (2.6 km) west of East Well Pad.	Undetermined	Undetermined	Undetermined	Yes	Yes	No	Yes
GR-7. West Staines State #1: 2.3 mi (3.7 km) west of the airstrip south turnaround.	Undetermined	Undetermined	Undetermined	No	Yes	No	No
GR-8. West Staines State #2: 3.3 mi (5.3 km) southwest of the airstrip south turnaround.	Undetermined	Undetermined	Undetermined	No	Yes	No	No
GR-9. Alaska State C-1: 1/3-mi (0.5 km) northeast of the airstrip north turnaround.	No	Yes	Undetermined	Yes	Yes	No	No

[1]This location would be acceptable for gravel reuse only if a future Far West Pad were constructed.

Table 2-15 Detailed Analysis of Gravel Reuse Site Options

Retained Gravel Reuse Site Options	Considerations			Status
	Technical	Logistical	Potential Environmental	
GR-1. Point Thomson Unit #1: 1.8 mi (2.9 km) west of CPF Pad and 1,300-ft north of West Well Pad access road.	≈ 14,000 cy gravel revegetation of site	Winter access only, construct ice road	Wildlife impacts: disturbance	Potential future use
GR-2. Point Thomson Unit #2: 1.4 mi (2.25 km) south of West Well Pad.	≈ 19,000 cy gravel revegetation of site	Winter access only, construct ice road	Wildlife impacts: disturbance	Potential future use
GR-3. Point Thomson Unit #3: 500-ft (152 m) north of CPF Pad.	Incorporate in situ for Central Well Pad	None.	Wildlife impacts: disturbance	Preferred
GR-4. Point Thomson #4: 2.6 mi (4.2 km) west of West Well Pad on the coast.	≈ 5,926 cy gravel revegetation of site	Winter access only, construct ice road	Wildlife impacts: disturbance	Potential future use
GR-5. Staines River #1: 1.8 mi (2.9 km) southwest of East Well Pad and 1 mi south of the East Well Pad access road.	≈ 4,722 cy gravel revegetation of site	Winter access only, construct ice road	Wildlife impacts: disturbance	Potential future use, depending on site assessment
GR-6. North Staines River #1: 1.6 mi (2.6 km) west of East Well Pad.	≈ 11,000 cy gravel revegetation of site	Winter access only, construct ice road	Wildlife impacts: disturbance	Potential future use, depending on site assessment