POINT THOMSON
GAS CYCLING PROJECT

PROJECT DESCRIPTION
REVISION A

Prepared by

ExxonMobil

September 23, 2002

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ACMP	State of Alaska Coastal Management Program
ACS	Alaska Clean Seas
ADEC	Alaska Department of Environmental Conservation
AOGCC	Alaska Oil and Gas Conservation Commission
API	American Petroleum Institute
BAT	best available technology
bbl	barrel(s)
BMP	best management practices
BOP	Blowout preventer
BOPE	Blowout prevention equipment
BTPO	Building the Production Operations
Btu	British thermal units
CCR	central control room
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CPF	Central Processing Facility
CPU	Central Processing Unit
CWP	Central Well Pad
cy	cubic yard(s)
DEIS	Draft Environmental Impact Statement
°F	degrees Fahrenheit
°C	degrees Celsius
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERD	extended reach drilling
ExxonMobil	ExxonMobil Development Company
FEED	front-end engineering design
ft	foot/feet
ft^3	cubic foot/feet
gal	gallon(s)
GCFD	billion cubic feet per day
G&I	grind and inject
ha	hectare(s)
HAZOP	hazard and operability
H_2S	hydrogen sulfide
hp	horsepower
HQ	headquarters
HMI	human/machine interface

in.	inch(es)
kg/m^2	kilogram(s) per square meter
km	kilometer(s)
kPa	kilopascal(s)
LP	low pressure
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
MAOP	maximum allowable operating pressure
MCFD	thousand standard cubic feet per day
mi	mile(s)
MOC	management of change
MSDS	material safety data sheet
MSL	mean sea level
MWP	maximum working pressure
NDT	non-destructive testing
NEPA	National Environmental Policy Act
NORM	naturally occurring radioactive materials
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NSB	North Slope Borough
OD&S	Operations Development and Support Group
ODPCP	Oil Discharge Prevention and Contingency Plan
OIMS	Operations Integrity Management System
OSHA	Occupational Safety and Health Administration
%	percent
PCS	process control system
POBP	Production Operations Best Practices
ppg	pounds per gallon
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psia	pounds per square inch atmosphere
psig	pounds per square inch gauge
PMT	Project Management Team
PTU	Point Thomson Unit
PUF	polyurethane foam
PW	produced water
RCRA	Resource Conservation and Recovery Act
Rev. A	Revision A
Rev. B	Revision B
RF	radio frequency
rpm	rotations per minute
ROW	right-of-way
SCADA	supervisory control and data acquisition
SHE	safety, health, and environmental
SOP	standard operating procedures
SO_2	sulfur dioxide
SSSV	subsurface safety valve
State	State of Alaska

TAPS	Trans Alaska Pipeline System
TCF	trillion cubic feet
TDS	top drive system
TVD	true vertical depth
TVDSS	true vertical depth subsea
UIC	Underground Injection Control
UPS	uninterrupted power supply
VOCs	volatile organic compounds
VSMs	vertical support members
WP	working pressure

1.0 INTRODUCTION

ExxonMobil Development Company (ExxonMobil) has prepared this Project Description to support the Environmental Impact Statement (EIS) process, as well as state, federal and North Slope Borough (NSB) permitting processes, associated with the Point Thomson Gas Cycling Project. The document is intended as a core (controlled) reference that describes the major design, construction, and operational features of the project. The Project Description will be issued as a series of revisions as project engineering and definition progress at key intersections of the engineering, EIS, and permitting processes. The Project Description is designed to ensure that all reviewers (state, federal, local and the public) have the same information and level of detail to assess the proposed project.

Revision A (Rev. A) of the Project Description has been produced to provide the agency EIS team and their third-party contractor with the current project design features and development concept as envisaged at the start of the EIS drafting process (September 2002). It is also intended to provide project information to support pre-application process discussions that ExxonMobil has entered into (or will shortly commence) with federal and state agencies and the NSB. Rev. A draws upon the project description in Section 3 of *The Point Thomson Gas Cycling Project Environmental Report*[1], amended in July 2002[2], and updates information to the extent ongoing early engineering studies have further defined the development concept. Rev. A describes ExxonMobil's base case project design as currently envisaged. As such, it does not describe project alternatives considered but rejected by ExxonMobil in arriving at the current design concepts. Also, Rev. A does not detail the extensive environmental and safety mitigation measures already incorporated into the project design (please refer to *The Point Thomson Gas Cycling Project Environmental Report* for details on project mitigation measures).

The basic development concept and design features have not substantially changed since Conceptual Engineering was completed in 2001 and the Environmental Report issued. It is envisaged that the basic project features such as the location of the facility and well pads and of the export pipeline route will remain essentially the same through Preliminary Engineering. Where appropriate, this Project Description contains comments on the level of project-scope definition to provide an understanding of where continuing engineering work will provide further definition over the next 18 months or so. Those comments draw attention to project features that may change as a result of early engineering studies or Preliminary Engineering.

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[1] URS Corporation (2001). *Point Thomson Gas Cycling Project Environment Report.* Prepared for ExxonMobil Production Company on behalf of the Point Thomson Unit owners by URS Corporation (Anchorage, Alaska). July 30, 2001.

[2] URS Corporation (2002). *Point Thomson Gas Cycling Project Environmental Report Addendum.* Prepared for ExxonMobil Production Company on behalf of the Point Thomson Unit owners by URS Corporation (Anchorage, Alaska). July 31, 2002.

Revision B (Rev. B) of the Project Description will be issued in early 2003 to provide updated information in time for the preparation of the Draft EIS (DEIS). This update coincides with the currently planned completion of Preliminary Engineering (early engineering studies are due to be complete in October 2002). As such, it is anticipated that Rev. B could be included as an appendix to the DEIS at the Environmental Protection Agency's (EPA's) direction. Rev. B will also support major permit applications to be submitted to the State of Alaska (State) and NSB in the spring of 2003 and for the Alaska Coastal Management Program (ACMP) consistency review process which should be initiated shortly thereafter.

1.1 PROJECT OVERVIEW

ExxonMobil proposes to develop the Thomson Sand reservoir in the Point Thomson Unit located east of Prudhoe Bay, Alaska. The Point Thomson Unit is composed of multiple State leases with different ownerships. ExxonMobil is the Unit Operator and has a working interest in the Unit of approximately 36 percent (%). Other major working interest owners include: BP Exploration Alaska, Inc. (~31%), ChevronTexaco (~25%) and ConocoPhillips (~5%). Other minor interests comprise the remaining 3%.

1.2 PURPOSE AND NEED

1.2.1 Purpose of the Project

The purpose of the proposed project is to produce gas condensate from the Point Thomson Unit and deliver that condensate to the Trans Alaska Pipeline System at Prudhoe Bay for shipment to market. This Project Description provides a summary of the current development concept for the preferred alternative, which has been selected based on engineering, economic, and environmental evaluations conducted during Conceptual Engineering.

1.2.2 Need for the Project

Development of this resource will help the United States meet domestic energy demand. Initial average annual production of condensate is expected to be approximately 75,000 barrels (bbl) per day. It is estimated this project could sustain economic production for 30 years or longer.

Through taxation and creation of jobs, the Point Thomson Gas Cycling Project will also provide economic benefits to the State and local communities including the NSB. This will include both temporary jobs during drilling and construction, and long-term jobs supporting permanent operations. Over the life of the project, significant benefits will accrue to the State and NSB through the payment of royalties, severance, income, and *ad valorem* taxes.

1.3 PROJECT SAFETY, HEALTH, AND ENVIRONMENTAL (SHE) OBJECTIVES AND STRATEGIES

ExxonMobil's primary SHE objective is to deliver exemplary safety, health, and environmental performance by providing a workplace free from accident and illness. Goals of this objective are no lost-time incidents, and overall safety, health, and environmental performance that equals or exceeds the best of international operators.

Strategies to ensure flawless execution of this objective include:

- Employing contractors experienced in the Alaskan North Slope environment, and keeping scope and execution approach within their proven capabilities;
- Learning from experience of prior projects, particularly those on the North Slope;
- Leveraging project management resources via an Engineering Procurement Construction Management contractor;
- Using proven ExxonMobil project management systems and practices;
- Engaging co-venturers via ongoing consultation and formal reviews;
- Including experienced personnel from co-venturers in the project team;
- Focusing on interface management and emphasizing ExxonMobil's high business ethical standards; and
- Implementing sound, verifiable business controls.

There are a number of design and operational features of the project that are planned to reduce environmental impacts and capital costs of the development (including the remoteness of Point Thomson from existing infrastructure):

- Shore-based extended reach drilling (ERD) from a minimum number of well pads;
- Use of the existing Badami and Endicott sales oil pipelines to transport condensate to the Trans Alaska Pipeline System (TAPS);
- No permanent roads to Badami or Prudhoe Bay infrastructure;
- Use of existing exploration pads and gravel where technically and economically feasible;
- Zero discharge policy for drilling wastes;
- Class I (Industrial) injection well for underground disposal of most waste streams including drilling waste, produced water, and camp discharges;
- Use of existing and new gravel mines at Point Thomson for freshwater sources; and
- Timing and/or routing of marine support operations to minimize potential disturbance to subsistence hunters and whaling crews.

1.4 PROJECT SUMMARY

The Point Thomson Unit is located on the North Slope of Alaska immediately west of the Staines River, approximately 22 miles (mi) (35 kilometer [km]) east of the Badami Development (Figure 1-1). Thomson Sand is a high-pressure gas reservoir that was discovered in 1977. The reservoir is estimated to contain more than 8 trillion cubic feet of gas and over 400 million stock tank bbl of recoverable condensate.

The Point Thomson Unit owners are proposing to develop this reservoir with a "gas cycling" project. A gathering pipeline system will collect production from well pads located on the eastern and western margins of the reservoir and deliver the three-phase stream to the Central Processing Facility (CPF). Gas, water, and hydrocarbon liquids (condensate) will be separated from the three-phase stream at the CPF. Dry gas[3] will re-injected into the reservoir at the Central Well Pad (CWP) located near the CPF. A small amount of the gas will be used to supply fuel for the facility. Produced water will be re-injected into one or more disposal wells at the CWP.

[3] The term "dry gas" refers to the gas leaving the process facilities and injected into the reservoir. This gas is stripped of condensate and produced water prior to injection.

Condensate is the hydrocarbon liquid that condenses from the production stream as the high pressure and high temperature of the reservoir are reduced in the surface gathering and processing facilities. The separated condensate will be dehydrated and stabilized at the CPF to meet pipeline specifications.

Also located at the CPF will be infrastructure designed to support remote operations including temporary and permanent camps; office, warehouse and shop space; normal and emergency power-generating equipment; fuel, water, and chemical storage; and treatment systems for potable and effluent water. An airstrip will be built south of the CPF, and a dock will be constructed adjacent to the CWP. Because no permanent roads between Point Thomson and Prudhoe Bay or other North Slope infrastructure are proposed, the dock and airport facilities are critical to supporting long-term operations.

The recovered hydrocarbon condensate will be shipped to market through a new 22-mile (35-km) export pipeline that will extend from Point Thomson to the Badami Development, where it will tie into the existing Badami and Endicott sales pipelines, with ultimate delivery to TAPS Pump Station No. 1.

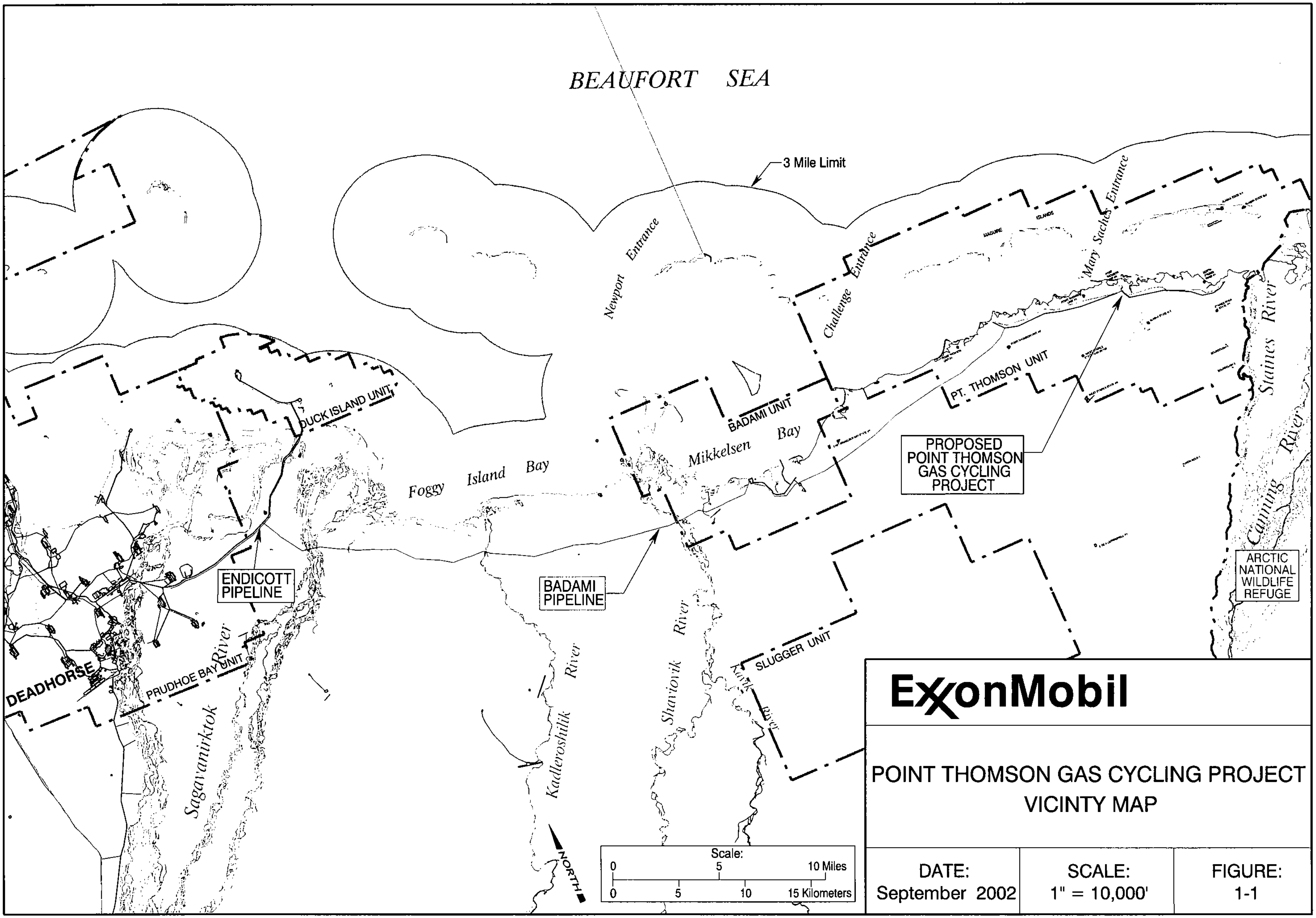
BEAUFORT SEA
3 Mile Limit
Newport Entrance
Challenge Entrance
Mary Sachs Entrance
Staines River
Canning River
ARCTIC NATIONAL WILDLIFE REFUGE
PT. THOMSON UNIT
PROPOSED POINT THOMSON GAS CYCLING PROJECT
BADAMI UNIT
Mikkelsen Bay
Foggy Island Bay
DUCK ISLAND UNIT
ENDICOTT PIPELINE
BADAMI PIPELINE
DEADHORSE
PRUDHOE BAY UNIT
Sagavanirktok River
Kadleroshilik River
Shaviovik River
SLUGGER UNIT
NORTH
Scale:
0 5 10 Miles
0 5 10 15 Kilometers
ExxonMobil
POINT THOMSON GAS CYCLING PROJECT
VICINTY MAP
DATE: September 2002
SCALE: 1" = 10,000'
FIGURE: 1-1

Fig1_1.dgn

2.0 SHE, SECURITY, AND REGULATORY PLAN

2.1 SAFETY, HEALTH, AND ENVIRONMENTAL (SHE) OBJECTIVES AND INTEGRITY MANAGEMENT

The overall SHE objective of the Point Thomson Gas Cycling Project is to deliver exemplary safety, health, and environmental performance. The vision held for the project and operations is a workplace free of accident and illness, with a commitment to deliver outstanding environmental performance. The Point Thomson Unit will conduct business in a manner that is compatible with the environmental and economic needs of the local communities.

The Point Thomson gas cycling facilities will be designed, constructed, and operated under and in accordance with all applicable laws and regulations. It will also be operated in compliance with the requirements of ExxonMobil's Operations Integrity Management System (OIMS), which is similar in structure and requirements to the Occupational Safety and Health Administration's Process Safety Management regulations. Key elements of OIMS are:

- *Management Leadership, Commitment, and Accountability:* Specific roles and accountabilities;
- *Risk Assessment and Management:* Ongoing risk management;
- *Facilities Design and Construction:* Standards and practices;
- *Information / Documentation:* Drawings and other required documentation;
- *Personnel and Training:* Skill maintenance and safety and health management;
- *Operations and Maintenance:* Procedures, programs including regulatory compliance;
- *Management of Change:* Permanent and temporary changes;
- *Third-Party Services:* Contractor management;
- *Incident Investigation and Analysis:* Root cause identification and global sharing;
- *Community Awareness and Emergency Preparedness:* Response planning/drills; and
- *Operations Integrity Assessment and Improvement:* Ongoing audit and findings resolution.

2.2 SAFETY, HEALTH, AND ENVIRONMENTAL PROGRAM

2.2.1 SHE Plan

SHE requirements for the project will be specified in overall and site-specific SHE plans covering the design, construction and operations phases. SHE requirements differ for each project phase and these requirements are described herein.

2.2.2 SHE Site-Specific Plan

Overall project and site-specific SHE plans will be developed and used throughout the life of the project to ensure that development and operational activities are carried out with maximum health and safety protection and minimized environmental impact. ExxonMobil's standard management systems and practices will be used, along with existing practices developed by Alaskan North Slope operators and industry, to develop Point Thomson specific plans. The *North Slope Operations Alaska Safety Handbook* and *North Slope Environmental Field Handbook* will be used for reference to address SHE issues associated with working in the Arctic.

Standard systems have been established and will be adapted for Point Thomson to provide a systematic approach to the management, monitoring and influencing of SHE concerns. These systems, including constructability and process safety reviews, will apply to all phases of the project from design to decommissioning. These systems will be communicated to contractors to ensure their understanding of ExxonMobil's expectations and philosophy.

Design Phase

SHE requirements will be incorporated into the design phase of the project by implementing certain design requirements, reviews, audits, and plans:

- *Hazard and Operability (HAZOP) for Process Hazard Analysis:* This technique will identify inadequacies with respect to safety and operability in design of process flow sequences to be addressed in the project design phase.
- *Facility Site Reviews:* The conceptual layout and the detailed design layout will be subject to a facility site review. This review will ensure that the location, layout and orientation of process plant, utility modules, control rooms, camps, wells, and drill rigs are such that hazards from gas release(s), fire(s), and explosion(s) are all minimized. These reviews are conducted with the plot plan, three-dimensional computer-assisted-drafting model and consequence analysis.
- *Independent Project Review:* Audits assess the readiness of the project to proceed to the next phase (Design ⇨ Construction ⇨ Operation).
- *Constructability Review*: These reviews are done to incorporate construction knowledge into the design. Construction-related hazards found during these reviews could be addressed in the design phase, allowing for engineered solutions to safety versus procedural safety.

Construction Phase

SHE provisions will be very important during the construction phase of the facility and pipeline. Established safe construction practices, together with a strong quality control/quality assurance program, will be used to ensure the health and safety of project personnel and the public, and minimize environmental impact during the construction and commissioning of the facility and pipeline. All personnel will observe and comply with all applicable federal, state, and local laws and regulations related to public health and safety, and the environment.

Construction techniques, plans, and personnel training will be implemented during construction to maximize health and safety protection and minimize environmental impacts. These include:

- Oil Discharge Prevention and Contingency Plan (ODPCP);
- Ice roads to prevent tundra damage;
- Most civil gravel work to be conducted during the winter to minimize impact on tundra;
- Polar bear interaction plan;
- Project personnel training on environmental awareness;
- Permit compliance training;
- Quality control/assurance (e.g., welding inspection, hydrotesting, etc.);
- Evacuation plans (medical and emergency);
- Safety and environmental risk analysis;
- Safety procedures, training, and meetings;
- Job Safety Analysis; and
- Waste management plan

Operations Phase

All necessary systems (e.g., procedures and documentation) required to conduct the affairs of the Point Thomson Unit operating organization in a safe and efficient manner will be developed and implemented through the ExxonMobil Production Company's Operations Development and Support Group (OD&S).

ExxonMobil's Production Reference Manual (PRM) for New Operations establishes operations system requirements to be in place at start-up. Implementation of the PRM requirements will ensure that all necessary systems are in place and that the new operating organization benefits from best practices derived from global operating experience. The requirements for management processes, operating procedures and documentation for new organizations are established by worldwide ExxonMobil standardized best practices and operating experiences. They incorporate ExxonMobil management systems modified for specific local requirements. Line management is accountable for ensuring that all necessary procedures and documents are implemented before start-up.

2.2.3 Environmental Goals

Environmental goals are defined as a set of criteria or objectives to be incorporated in project design and during planning for construction and operations. The principal environmental goals are to:

- Develop an environmentally sound project,
- Assure compliance with regulatory requirements and internal company expectations, and
- Address concerns of local residents.

The goals selected for the Point Thomson Unit development are based on applicability to the Unit area and reservoir characteristics, technical feasibility, economic feasibility, and effectiveness in reducing environmental impacts. These environmental goals are one component of the set of project mitigation measures including baseline studies, agency consultation, and public outreach.

The Point Thomson Project Management Team (PMT) understands that there are many environmental considerations and issues that must be addressed effectively throughout the project. Specific project environmental mitigation measures are delineated in the *Point Thomson*

Gas Cycling Project Environmental Report (July 2001)[1] and its Amendment (July 2002)[2]. The following list identifies potential issues:

- Caribou herd migration, insect relief, calving;
- Polar and grizzly bears / Other carnivores;
- Birds (including threatened and endangered species;
- Marine mammals (including threatened and endangered species);
- Fish and fish habitat;
- Air quality;
- Water quality and quantity;
- Spill prevention and response planning;
- Placement of gravel fill;
- Waste management;
- Archaeological sites; and
- Subsistence use and other local community issues.

These and other environmental issues have been addressed during conceptual engineering or will be addressed during subsequent engineering phases. Accordingly, they will be reviewed and updated on a regular basis. This will allow environmental mitigation measures to reflect more detailed design information and to be based on a more complete understanding of agency and public concerns.

2.3 SECURITY

Point Thomson is remotely located in a sparsely populated area and not connected to other North Slope communities by permanent road. Customary security plans for similar operations in the area include coordination with local and state police agencies when some unusual security concern or event is experienced.

As with other North Slope industrial facilities, public access will be regulated to ensure facility security and safety. There is minimal documented use of the onshore area for significant subsistence use; however, local residents may occasionally pass through the Point Thomson Unit. ExxonMobil understands the need for public access and pass-through, and will provide access as necessary without compromising site control and safety issues. Hunting will be prohibited in the immediate vicinity of pipeline and other production facilities to prevent accidental damage, and reasonable precautions will be taken (locking critical valves, equipment buildings, etc.) to discourage or prevent vandalism or sabotage.

During the construction/drilling phase of the project, the local workforce at Point Thomson will be larger and traffic will be substantially higher than later during operations. Temporary ice roads will link Point Thomson to Prudhoe Bay infrastructure during construction and perhaps occasionally during operations, depending on logistics needs. Therefore, it will be necessary to

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provide additional security resources when ice road access is available. Security plans for both construction/drilling and operating phases will be developed as part of the project execution plan.

2.4 REGULATORY REQUIREMENTS

Federal, state and local (NSB) approvals will be required for construction and operation of this project. The National Environmental Policy Act (NEPA) process is required for review of all federal permits, and for this project it has been determined that an EIS has to be prepared to comply with NEPA. The State of Alaska is landowner and oil and gas lessor of the Point Thomson Unit and along the proposed export pipeline corridor, and therefore has a major role in project land use and resource development approvals. These include approval of a Unit Plan of Development for surface facilities construction and issuance of a Right-of-Way Lease for the export pipeline. An ACMP consistency review is required for nearly all state and federal permits to ensure conformance with policies and standards of the ACMP and the NSB's Coastal Management Program. The Point Thomson Unit is located within the NSB, and the project requires approval from the NSB under the provisions of its Title 19 Land Management Regulations.

3.0 RESERVOIR

The Point Thomson Field is a major hydrocarbon accumulation that was discovered in 1975. The primary reservoir, the Thomson Sand, was discovered in 1977 and is a large, over-pressured gas-condensate reservoir located approximately 12,750 feet (ft) (3,886 meters [m]) below sea level. A total of 19 exploration wells have been drilled in and around the field (see Figure 3-1), and numerous seismic surveys have been acquired to further delineate this extensive (approximately 23 mi by 8 mi [37 km by 13 km]) resource. The western edge of the field is about 45 mi (72 km) east of Prudhoe Bay, and the nearest surface facility is the Badami Development, located about 22 mi (35 km) west of the Point Thomson CPF (see Figure 1-1).

In 1977, the Point Thomson Unit was formed, and the State designated ExxonMobil (formerly Exxon Company U.S.A.) as the Unit Operator. Throughout the 1980s and 1990s, ExxonMobil and other Point Thomson Unit owners continued to delineate the Thomson Sand and shallower Brookian accumulations within the Unit while conducting development feasibility studies. In April 2000, interests among the major Point Thomson Unit owners were realigned for all horizons. Currently, the Point Thomson Unit covers approximately 117,000 acres (47,348 hectares [ha]).

In 1977 the Thomson Sand reservoir was discovered by the Point Thomson Unit #1 well. A total of 14 wells drilled in or around the Point Thomson Unit have penetrated the Thomson Sand interval. The last well that penetrated it was the Alaska State G-2, which was drilled in 1983. In the 1990s, the Sourdough and Red Dog exploration programs targeted the shallower Brookian (Lower Tertiary) oil sandstones and did not drill down to the Thomson Sand. Tests from these exploration wells indicate that the Brookian sandstones have low productivity and limited extent.

3.1 GENERAL RESERVOIR DESCRIPTION

The Lower Cretaceous Thomson Sand is interpreted as a shallow-marine fan delta complex. The fan delta sediments were sourced from a northwest-southeast trending paleohigh that underlies the general location of the present-day barrier islands. The primary depositional processes are inferred to be sediment gravity flows. The Thomson Sand thickness varies widely across the field, ranging from 0 ft (0 m) up to a maximum penetrated thickness of 350 ft (107 m). A generalized cross-section of the Thomson Sand is shown in Figure 3-2.

The lithologies encountered in the Thomson Sand reservoir range from conglomerates to sandstones to sandy mudstones. No true shales have been observed within the interval. Grain composition is dominated by dolomite, argillite, quartzite, and sedimentary rock fragments. Primary controls on reservoir quality include depositional fabric (grain size and sorting), compaction, and calcite cementation.

The hydrocarbon trapping mechanism for the Thomson Sand is interpreted as a combination of structural closure, stratigraphic pinchout, and geologic facies changes, with structural closure being the dominant mechanism. The intersection of the dipping Thomson Sand and the fluid contacts define the downdip limit of the accumulation over most of the area. A generalized outline of the accumulation is shown in Figure 3-3.

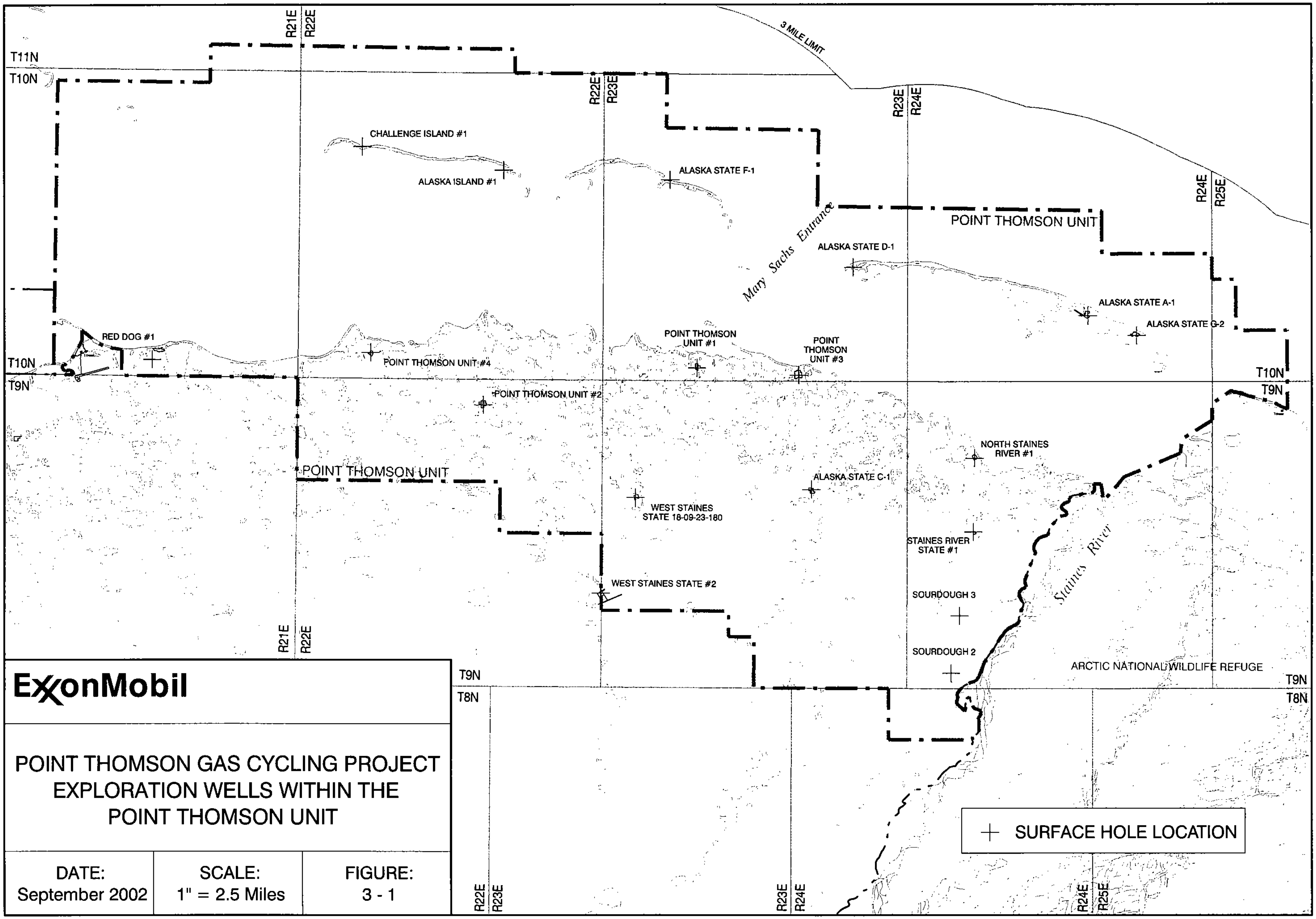
The Thomson Sand reservoir is estimated to contain over 8 trillion cubic feet (TCF) of natural gas in place over an area of approximately 60,000 acres (24,280 ha). The carbon dioxide (CO_2) concentration in the natural gas is approximately 4.5%. The natural gas is considered to be sweet (hydrogen sulfide [H_2S] is absent or present in trace amounts). The hydrocarbon liquids yield is expected to be about 55 to 60 bbl of condensate per thousand standard cubic feet of produced natural gas.

3.2 DEPLETION PLAN AND RESERVES

The proposed base development plan at Point Thomson is a gas cycling project in the Thomson Sand to enable sales of the hydrocarbon liquids (condensate) contained in the natural gas in the reservoir. Wet gas will be produced initially at a nominal rate of 1.5 billion cubic feet per day (GCFD), from which the condensate will be extracted. The recovered condensate will be shipped to market through a new 22-mi (35-km) export product pipeline that will extend from Point Thomson to the Badami Development, where it will tie into existing infrastructure (Badami and Endicott sales pipelines) with ultimate delivery to TAPS Pump Station No. 1. The remaining produced natural gas (less fuel and shrinkage) will be returned to the Thomson Sand reservoir.

It is anticipated that the field will be produced from 13 wells drilled from two onshore pads; one pad situated on the east side of the reservoir and one on the west side (Figure 3-3). This strategy will require an extended reach drilling program with horizontal offsets up to 21,000 ft (6,400 m). Production wells are planned to have large 7-inch (in.) tubing to enable high withdrawal rates. Once the condensate is removed, the dry gas will be compressed and injected into the Thomson Sand through wells drilled from an onshore pad (Central Well Pad) located towards the center of the field. In order to maintain high condensate production, and minimize breakthrough of injected dry gas, the bottom-hole locations for the producing wells are located at a distance from the more-centrally located dry-gas injection wells.

Condensate production rates are expected to peak early in the life of the project, once all the production and injections wells are completed and placed on-line. Ultimately, the Point Thomson Gas Cycling Project is expected to recover over 400 million bbl during its 30-year lifespan.

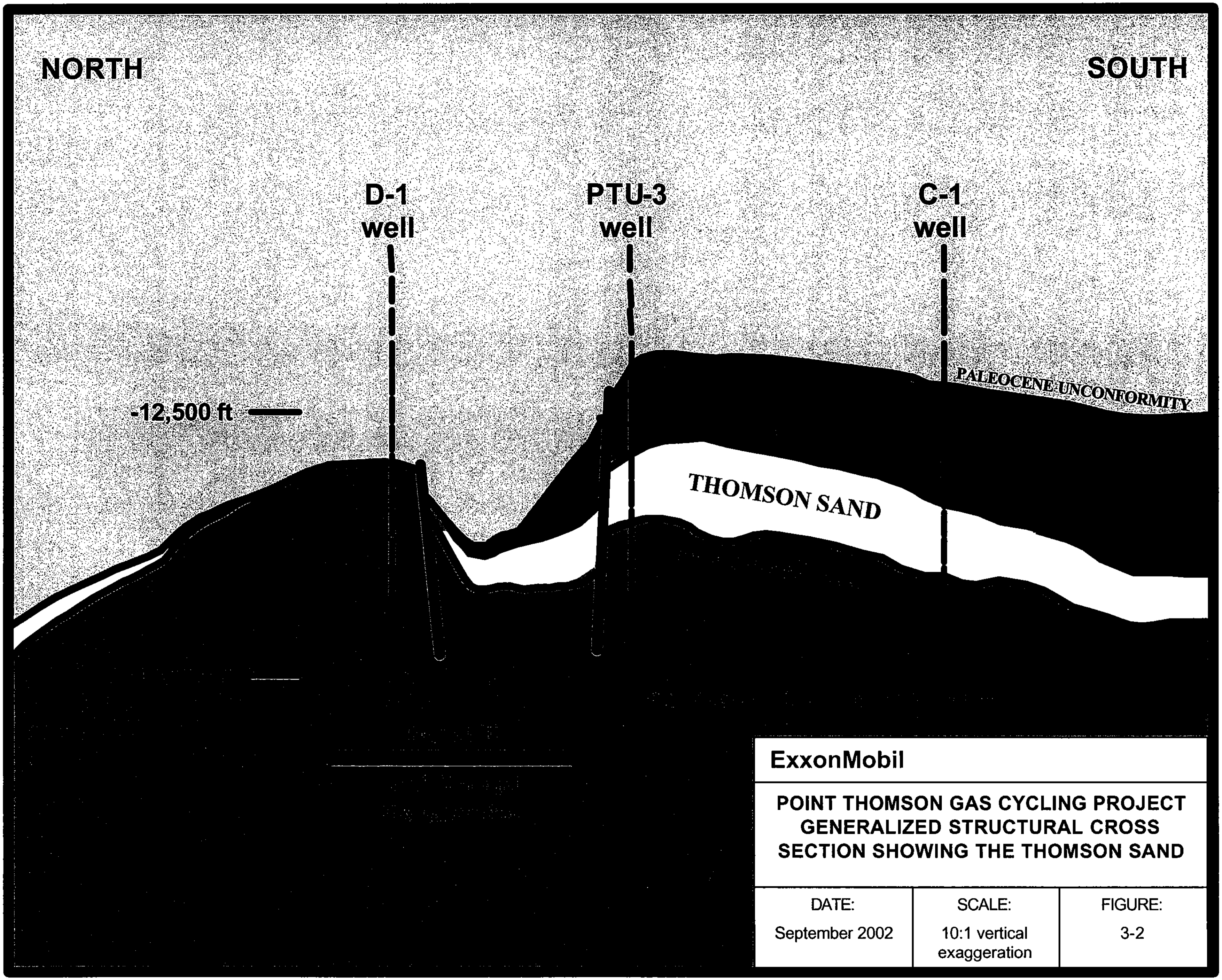


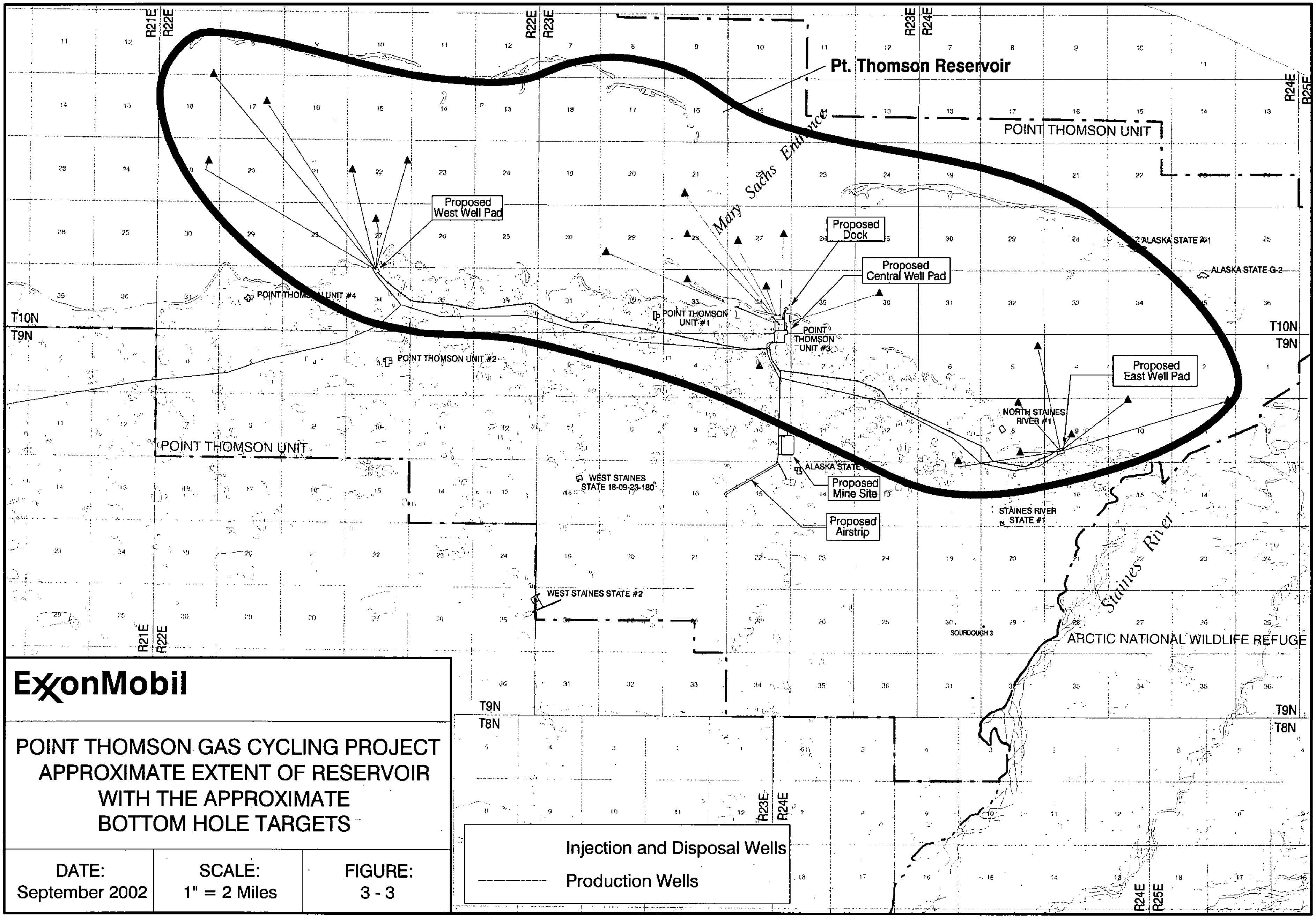
ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
EXPLORATION WELLS WITHIN THE
POINT THOMSON UNIT

DATE:	SCALE:	FIGURE:
September 2002	1" = 2.5 Miles	3 - 1

fig3_1.dgn


NORTH
SOUTH
D-1 well
PTU-3 well
C-1 well
-12,500 ft
PALEOCENE UNCONFORMITY
THOMSON SAND
ExxonMobil
POINT THOMSON GAS CYCLING PROJECT GENERALIZED STRUCTURAL CROSS SECTION SHOWING THE THOMSON SAND
DATE: September 2002
SCALE: 10:1 vertical exaggeration
FIGURE: 3-2



POINT THOMSON GAS CYCLING PROJECT
APPROXIMATE EXTENT OF RESERVOIR
WITH THE APPROXIMATE
BOTTOM HOLE TARGETS

DATE:	SCALE:	FIGURE:
September 2002	1" = 2 Miles	3 - 3

fig3_3.dgn

4.0 DRILLING

4.1 OVERVIEW

The Point Thomson Gas Cycling Project will be developed by drilling and completing 13 production wells and 8 gas injection wells in the Thomson Sand, and one Class I disposal well to be drilled in the shallower Sagavanirktok from three onshore pad locations. All wells will require directional drilling to reach the desired bottom hole. All bottom-hole targets lie beneath the lagoon except for the Class I disposal well and one East Well Pad production well (Figure 3-3). It is anticipated that this project will require the drilling and completion of 13 production wells, eight gas injection wells, and one Class I waste disposal well (Table 4-1). It is also possible that at least one Class II waste disposal well will be drilled during the project.

The Point Thomson production and gas injection wells are considered long-life, very prolific, high-pressure wells (>0.8 pounds per square inch [psi] per ft vertical depth as defined by industry). The high pressure differentiates the Point Thomson wells from other North Slope wells. The working pressure requirements for blowout prevention equipment and producing wellheads and trees are 10,000 psi (68,950 kilopascals [kPa]), while the requirements for the injection wellhead and tree are greater than 10,000 psi due to high-pressure compression needs. The working pressure of most equipment on the Slope is 5,000 psi (34,475 kPa) or less.

Special emphasis will be placed on well design, procedures, communication, and training to ensure the wells can be safely drilled, completed, produced, and maintained. A minimum of two safety barriers will be in place at all times while work is progressing. For example, during drilling, the drilling fluid will act as one barrier and the blowout prevention equipment will act as another. In the case of producing the well, the subsurface safety valve and the tree would act as barriers. If a barrier is compromised, work will be stopped and the barrier restored before proceeding with the work. The purpose of this philosophy is to prevent a single point failure from escalating.

TABLE 4-1
WELL COUNTS

PAD	NUMBER OF WELLS
West Well Pad	6 Production Wells
Central Well Pad	8 Gas Injection Wells & 1 Disposal Well
East Well Pad	7 Production Wells
Total	22 Wells

The high pressure will require heavier (thicker-walled) casing and tubing than normally used on the North Slope. Special emphasis will be placed on the selection of metallurgy to ensure the structural integrity for a long life at high pressure.

The production and injection wells will be large bore with 7-in.-nominal-diameter tubing. Two rigs will be used and likely mobilized to Point Thomson by barge a year before the CPF modules are delivered to Point Thomson.

It is anticipated that the Class I non-hazardous disposal well will be one of the early wells scheduled to be drilled. This well will be used initially to dispose of the slurrified cuttings generated from the drilling of the development wells. In addition, this same well will be used to dispose of produced water, wastewater effluent from the camps, and exempt and other non-hazardous waste.

4.2 TARGET LOCATIONS

Figure 3-2 shows the preliminary target locations for the 8 injection wells, 13 production wells, and one disposal well. It is anticipated that the actual target locations will change as additional reservoir data is obtained.

4.3 WELLS

Siting for the well surface locations and allocation of space on the well pads for drilling operations are governed by several criteria:

- A minimum of 22 wells (21 production and injection wells and 1 disposal well) on three separate drilling pads,
- Flexibility in rig selection,
- Ability for future well interventions,
- Need for storage and handling of large quantities of consumables during freeze-up and breakup,
- Allowance for simultaneous drilling and production operations,
- Minimizing wellbore intersection possibilities,
- Mitigating collateral damage in the unlikely event of an uncontrolled hydrocarbon release due to failure of tree and safety equipment, and
- Minimizing well departure.

Based on ongoing studies, the well spacing at each pad could be as much as 40 ft (12 m).

4.4 WELL DESIGN

4.4.1 Well Profiles

The well profiles will be vertical through the permafrost and then deviated immediately below the permafrost. This will provide additional separation from other wells as the hole is drilled deeper. It is envisioned that surface casing will extend through the section of the hole that defines the well deviation angle. This maximum hole angle will be maintained all the way to the reservoir target. This profile will minimize the hole angle required to reach the reservoir target. It is anticipated that the maximum hole angles will likely be between 20° and 67°. These hole angles allow wireline and/or coil tubing work to facilitate completions and workovers.

4.4.2 Casing Seats

Development well design, including casing seat locations, is based on Point Thomson exploration and appraisal well design, and on North Slope drilling practices. A typical Point Thomson development well is anticipated to have the following casing seats (Table 4-2):

- *Conductor:* The conductor hole will be drilled, and the conductor will be cemented in place for all wells at approximately 80 ft (24 m) true vertical depth (TVD). This will be done during pad construction. Conductors will be insulated and designed to minimize thawing of adjacent permafrost.
- *Surface Casing:* This casing will nominally be set in the shale barrier within the Sagavanirktok Formation (about 3,700 ft [1,130 m] TVD).
- *Intermediate Casing*: This casing will be used as required to ensure the protective/production casing can be set in the pressure transition zone.
- *Protective/Production Casing:* This casing will be set when the mud weight required to drill the intermediate hole is appropriate.
- *Production Liner:* The well will reach total depth at the base of the Thomson Sand reservoir at approximately 13,300 ft (4,050 m) TVD.

Wellbore stability studies which will further optimize the design are ongoing. Setting depths may be adjusted with new interpretation of mud weight and fracture predictions. Emphasis will be placed on reducing conductor and surface casing size to minimize cuttings waste discharge. Detailed well designs will be included in the Permit to Drill applications submitted for AOGCC approval.

TABLE 4-2
TYPICAL PRODUCTION AND INJECTION WELL CASING PROGRAM

CASING / HOLE SIZE		SETTING DEPTH (TVD)	FORMATION
Low-Angle Well	High-Angle Well		
30-in. Conductor (Preset)	30-in. Conductor (Preset)	±80 ft (24 m)	N/A
18-5/8-in. Surface Casing/ 24-in. Hole	18-5/8-in. Surface Casing/ 24-in. Hole	±3,700 ft (1,130 m)	Sagavanirktok (Tertiary)
N/A	13-3/8-in. Intermediate Casing/16-in. Hole	As Required	
9-5/8-in. Protective/ Production Casing/ 12-1/4-in. Hole	9-5/8-in. Protective/ Production Casing/ 12-1/4-in. Hole	±10,800 ft (3,290 m)	Canning (Lower Tertiary)
7-in. Production Liner/ 8-1/2-in. Hole	7-in. Production Liner/ 8-1/2-in. Hole	±13,300 ft (4,050 m)	Thomson Sand (Lower Cretaceous)

4.4.3 Drilling Fluids

The anticipated drilling fluids program provided in Table 4-3 will be further refined based on wellbore stability modeling. The stability modeling will also help determine if a 16-in. contingency hole will be required in the higher-angle well to help build formation integrity for drilling the 12-1/4-in. hole. Refinements to the hole sizes will be made once the well has been optimized and final casing selection is made.

TABLE 4-3
TYPICAL DRILLING FLUIDS PROGRAM

HOLE SIZE/SECTION		DRILLING FLUID TYPE	DRILLING FLUID WEIGHT RANGE (ppg)
Low-Angle Well	High-Angle Well		
30-in. Conductor (Preset)	30-in. Conductor (Preset)	N/A	N/A
24-in. hole	24-in. hole	Freshwater Gel	8.8 to 10.0
N/A	16-in. hole	Non Aqueous Fluid	8.8 to 13.0
12-1/4-in. hole	12-1/4-in. hole	Non Aqueous Fluid	8.8 to 14.0
8-1/2-in. hole	8-1/2-in. hole	Non Aqueous Fluid	14.0 to 16.5

4.4.4 Class I Disposal Well

One EPA Underground Injection Control (UIC) Class I disposal well is planned for Point Thomson. The well will have approximately 2,000 ft (610 m) of separation from any other well at approximately 7,000 ft (2,135 m) TVD (the top of the upper injection zone). The well will be used primarily for disposal of cuttings and wastewater effluent initially and subsequently for disposal of wastewater, produced water, and exempt and other non-hazardous wastes.

The current well design includes 18-5/8-in. conductors at about 80 ft (24 m), 13-3/8-in. surface casing set at approximately 2,000 ft (610 m) TVD subsea (TVDSS), and 9-5/8-in. casing set at approximately 7,800 ft (2,380 m) TVD. The casing will be perforated through the injection zone and sealed with a permanent packer. It is anticipated that 7-in. tubing will be used for injection. Table 4-4 provides expected waste volumes of mud and cuttings for each well type.

TABLE 4-4
EXPECTED WASTE VOLUMES FOR POINT THOMSON WELLS

WELL TYPE	WASTE GENERATED (bbl)	TOTAL SLURRY INJECTED (bbl)
<17,000 ft (measured depth)	~11,500	~ 34,000
>17,000 ft (measured depth)	~19,000	~57,000
Disposal Well	~4,000	~12,000

The total slurry injected includes water used to dilute slurry for injection. Annular injection on each pad is being studied to reduce the amount of solid-laden material injected into the Class I disposal well.

4.4.5 Well Control

Two types of development wells are planned for Point Thomson: production and gas injection. All wells will have subsurface safety valves (SSSV) in the completion string, and all wells will have wellheads and Christmas trees consisting of:

- Master valve (manual),
- Surface safety valve (actuated),
- Wing valve (manual), and
- Swab valve (manual).

The well cellars for all wells will be lined with an 8-ft-diameter culvert set in the gravel pad, and then 6 in. of cement will be poured in the base.

The Thomson Sand reservoir is abnormally pressured to about 10,150 psi (70,000 kPa), and the maximum anticipated surface pressure with gas to surface is about 8,300 psi (57,250 kPa). The top of abnormal pressure varies from about 11,600 ft (4,880 m) TVDSS in the east to as high as 9,700 ft (2,960 m) in the west. No shallow hazards have been encountered in any of the 19 exploration wells drilled in the Point Thomson area while drilling with the diverter or blowout preventer (BOP). All development wells will use a diverter for drilling surface-hole sections until it can be demonstrated that shallow hazards do not exist on each pad. A stack with four rams and one annular preventer will be used to drill below surface casing. The rams and annular preventer stack will be rated to 10,000 psi (68,950 kPa) working pressure.

All well control training, operational practices, procedures, rig equipment, and testing will be in accordance with Alaska Oil and Gas Conservation Commission (AOGCC) regulations and ExxonMobil standards.

In the unlikely event that a well control incident escalates to a blowout, existing equipment (i.e., dynamic kill, bullheading, etc.) and well capping will be the primary means of controlling the blowout. Well capping has proven to be extremely effective in bringing wells under control and facilitating well kills, and is more expedient than a relief well. Killing the well after capping can be completed without a rig (i.e., bullheading kill weight mud) through the existing wellbore. In the unlikely event well capping does not work, then a relief well will be drilled. (Note that 78 out of 78 wells in Kuwait were successfully capped following the Gulf War.) Information detailing best available technology (BAT) for controlling a blowout will be presented in the ODPCP to be submitted to the Alaska Department of Environmental Conservation (ADEC) and other agencies.

4.5 WELL TESTING

Well testing is planned for some of the wells located on the East and Central Well Pads before process facilities are operational. A typical well test would be conducted through a portable separator, flaring the gas until facilities are operational, at a maximum rate of 35 million standard cubic feet per day, for a maximum duration of 4 days.

4.6 DRILLING EQUIPMENT AND MATERIALS

At present, the use of two drilling rigs is planned for drilling and completion of the wells. Preliminary rig specifications are:

- *Design:* Arctic conditions;
- *Top Drive System (TDS):* 100 rotations per minute @ 62,000 foot-pounds of torque;
- *Drawworks:* 3,000 horsepower (hp);
- *Mast:* 1,200,000 pounds;
- *Mud System:* 2,500 bbl (1,500 bbl active and 1,000 bbl reserve);
- *Blowout Prevention Equipment (BOPE):* 10,000 psi (68,950 kPa);
- *Shale Shakers:* 3 to 4 linear motion;
- *Mud System:* Three 1,600-hp mud pumps;
- *Drillpipe:* 6-5/8-in., 5-in., 4-1/2-in., etc. (S-135 as a minimum); and
- *Extra Diesel Storage:* 20,000 gallons per rig.

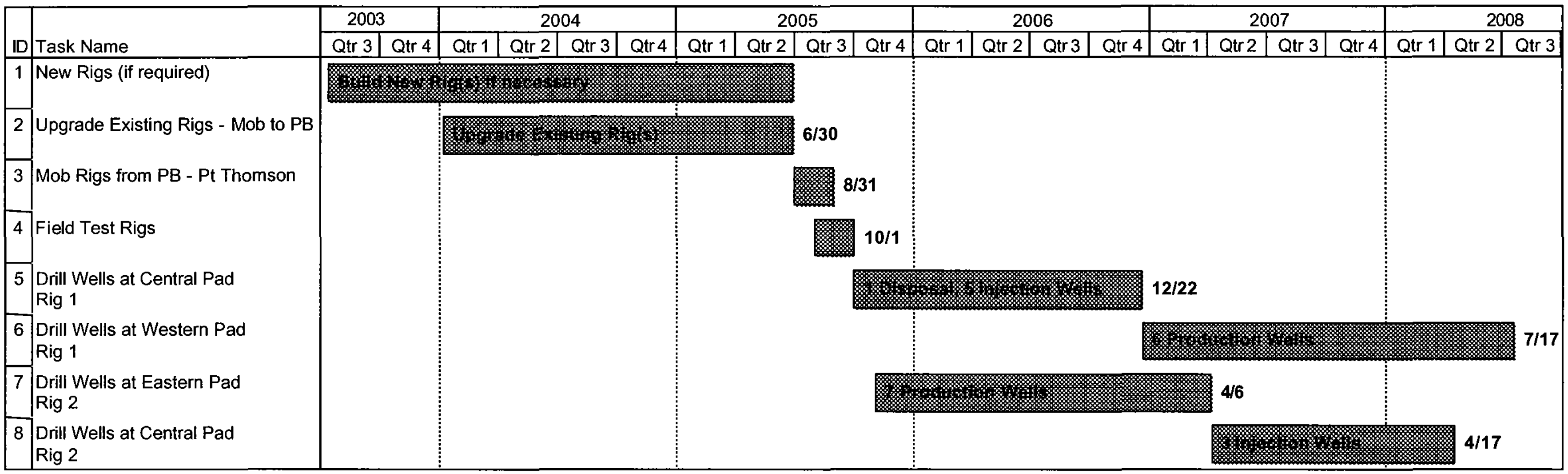
These requirements will be better defined once well optimizations are made. The exact rigs to be used will not be known until December 2003.

Results from Conceptual Engineering have the rigs powered by highline power. Initially the power would be from diesel-powered emergency generators at the CPF. Once gas and the gas-powered turbines are available on the CPF, the power would come from these facilities. Two other options for providing rig power are being considered:

1. Early use of highline power provided by diesel-powered emergency generators, later switching to natural-gas internal combustion engines on the rigs from produced natural gas back-flowed from an early injection well.
2. Dual-fuel rig engines converted from diesel to gas when the necessary gas facilities are in place.

4.7 DRILLING SCHEDULE

The drilling rigs and associated equipment will be mobilized by barge from the Prudhoe Bay area during July to August 2005. Drilling is scheduled to start in October 2005 and will continue through July 2008. Figure 4-1 provides the proposed drilling sequence for production, disposal, and gas injection wells.



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POINT THOMSON GAS CYCLING PROJECT PROPOSED DRILLING SEQUENCE

DATE:	SCALE:	FIGURE:
September 2002	N/A	4-1

5.0 PROCESS FACILITIES

5.1 PROCESS OVERVIEW

The Thomson Sand reservoir is being developed as a gas cycling project. Under this development plan, three-phase full-well-stream production gathered from remote well pads (East and West Well Pads) will be sent to a Central Processing Facility (CPF) where the condensate will be separated and stabilized to meet sales pipeline specifications. The dry gas will then be re-injected at the Central Well Pad (CWP) located adjacent to the CPF. A small amount of the gas will be used to fuel the facility. These facilities are described in detail in the following sections. Figure 5-1 is a simplified flow diagram showing the basic conceptual CPF process, while Figure 5-2 is a map showing the overall layout of the well pads, CPF, and related pipelines and infrastructure (roads, dock, airstrip, etc.).

The development basis consists of a "three-train case" in which production rates are dictated by the capacities of the three injection compressor trains. The term "train" is used to define a collection of facility components, usually organized in series, which together perform a basic process function. This term is typically used when referring to the number of similar groupings of components that are parts of an overall plant or facility. Therefore, "three trains" of injection compression indicates that there are three sets of equipment of similar design and capacity (Figure 5-3). Each train is discrete and does not share components with the other trains. For the three-train cycling case, there are three trains of injection compression and two trains of flash gas compression.

5.2 PRODUCTION WELL PADS

Both the East and West Well Pads will be production well pads. The West Well Pad will be located approximately 7 mi (11 km) west of the CPF Pad; the East Well Pad will be approximately 6 mi (9 km) southeast of the CPF. Figures 5-4 and 5-5 show plan views for the East Well Pad and West Well Pad, respectively. The exact shape, dimensions, and layout of the pads will change as further definition of facilities occurs as engineering design matures. Significant features and approximate dimensions of the East and West Well Pads include the following:

- East Well Pad, which can accommodate up to nine production wells (base case = 7), will cover about 6 acres (2.4 ha).
- West Well Pad, which can accommodate up to eight production wells (base case = 6), will cover approximately 5 acres (2.0 ha).
- Both pads will be surface-graded to allow for effective spill collection.

The East Well Pad will have approximately seven production wells, with space provided for up to two additional wells, if needed. During the drilling phase, much of the pad area will be taken up with facilities and services to support drilling, including a temporary early-fuel-gas conditioning skid. When production begins, the facilities located on this pad will include production manifolds, well metering and control facilities, an electrical building, methanol tank and injection system, and a gathering-line pig launcher. Production wells will be aligned in a row and spaced up to 40 ft (12 m) apart as described in Section 4.3. Production from each well will be measured using three-phase meters, and thus, a permanent test separator is not envisioned at this time.

The facilities provided on the West Well Pad will be similar to those on the East Well Pad. Differences arise due to the number of wells planned.

5.3 PRODUCTION GATHERING LINES

Production fluids from both the East and West Well Pads will be piped from the well manifolds to the gathering lines and then to the CPF. Construction material for the gathering lines is currently being evaluated and will be chosen at a later date. The gathering lines will be configured with a pig launcher on the well pad end and a pig receiver at the CPF end. The lines will be placed on vertical support members (VSMs) sized to maintain a minimum 5 ft (1.5 m) height above the tundra. The gathering lines will be routed on the inland side of the access roads so that the road will act as a containment barrier in the event of a line leak. Pressure monitoring is planned as the primary means of leak detection for gathering lines, which will also be visually monitored from the infield roads during the course of routine operations. This is a typical means of monitoring gas gathering lines.

The well flow rate and inlet pressure to the gathering lines will be controlled so that the normal minimum delivery pressure at the plant will be approximately 3,040 psi atmosphere (psia) (20,960 kPa). Normal flowing temperatures in the gathering lines will be over 170° Fahrenheit (°F) (77° Celsius [°C]), with normal temperature drops of 10°F (5.5°C) or less. Because the estimated hydrate point of the produced gas at flowing pressure is ~80°F (27°C), the gathering lines will be insulated to delay cooling of the piping to ambient conditions when the flow is stopped or restricted. This will allow additional time to resolve operating problems and resume flow before potential hydrate formation in the gathering line and associated problems occur.

5.4 CENTRAL PROCESSING FACILITY

The CPF Pad is the largest of the gravel pads and the location for the Central Production Facility including the main gas-processing modules, and related support and infrastructure facilities. Figure 5-6 provides the plan view, while Figure 5-7 shows the cross-section of the conceptual CPF Pad. While the exact shape, dimensions, and layout of the pad will change as engineering design matures, the total area of the pad is not expected to change significantly. Some of the significant features of this pad are follows:

- The pad will have an approximate area of 21 acres (8.5 ha), and
- The pad will be surface-graded to allow for spills to be efficiently collected and routed away from the CPF and camp infrastructure.

The CPF Pad layout will be as required to accommodate the CPF modules and equipment, the permanent camp, the construction/drilling camp, the camp utility module, the warehouse, the power generation modules, the control room, the communications tower and building, the diesel and methanol storage, a cold storage area, and all associated pipe racks, cable racks, and storage equipment. In addition, there will be a short road to accommodate maintenance access to the CPF high- and low-pressure flares. The final layout of the equipment will accommodate the best arrangement for construction, operation, safety, and fire protection.

5.5 INJECTION LINES AND CENTRAL WELL PAD

The CWP will be located adjacent to and directly north of the CPF Pad. During the early construction phase of the project, the CWP will be used primarily to support drilling operations. It will contain a Class I disposal well, the grind and inject (G&I) facility (a mobile G&I facility with the rig is currently being evaluated as an alternative), drilling equipment and supplies, a mud plant, an electrical building, an early-fuel-gas treating facility, and storage areas for drilling activities. Approximately eight gas injection wells will also be drilled from the CWP. Space is available for two additional wells on the CWP in the event that one or more wells not currently planned for are needed for the project. High-pressure gas piping will transport the gas from the CPF Pad to the injection wells located at the CWP.

Figures 5-8 and 5-9 provide the plan view and cross section, respectively, of the conceptual CWP. While the exact shape, dimensions, and layout of the pad will change as engineering design matures, the overall area is not expected to change significantly. Important features of the CWP include the following:

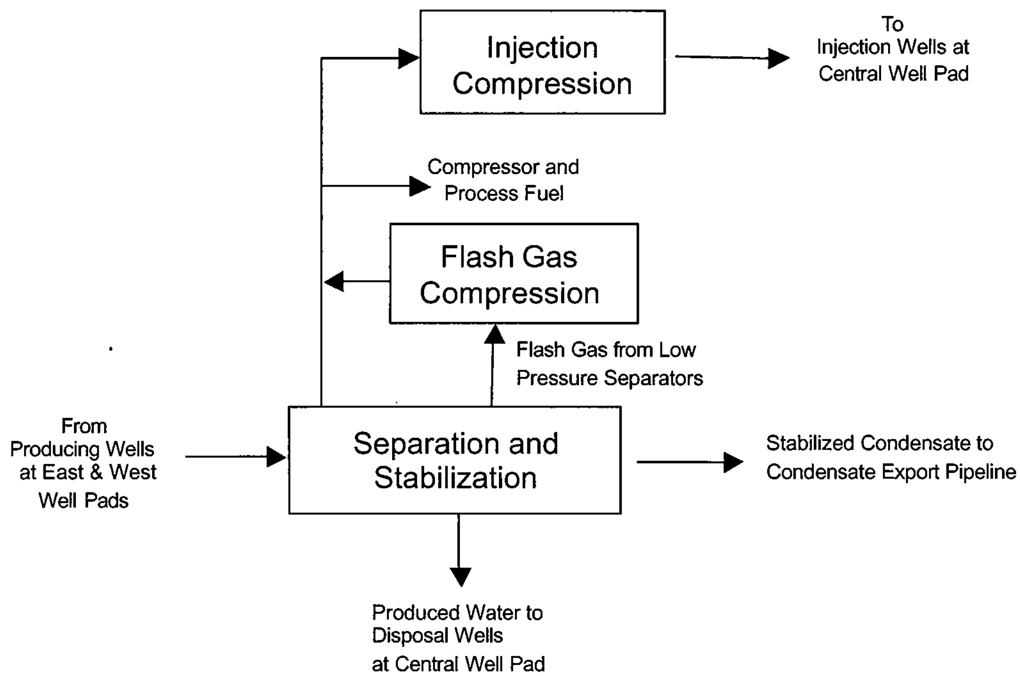
- The pad will have an approximate area of 15 acres (6 ha).
- The pad will incorporate the existing Point Thomson Unit #3 exploratory gravel pad.
- The pad will be surface-graded to allow for spills to be efficiently collected and routed away from the wells, well-pad facilities, and adjacent CPF.
- Construction material for the injection lines is currently being evaluated and will be chosen during Preliminary Engineering.

Wells on the CWP will be aligned in a row and spaced up to 40 ft (12 m) apart. Flow meters will be installed on each gas injection well to measure the volume of gas injected. Separate piping will transport treated camp gray water and produced water from facilities on the CPF to the EPA UIC Class I waste disposal facilities (i.e., piping manifolds and disposal pumps) on the CWP.

The well pad area and design will be adequate to accommodate the initial drilling operations and drilling storage requirements to support work at the satellite pads as well. The pad will also be suitable for ongoing well maintenance and service rig access, and future drilling activities, as well as for the equipment and facilities needed for gas injection.

Permanent facilities to be located on the CWP include a separator and fuel-gas-treating skid for providing early fuel gas and fuel gas for a plant back start.

Gas discharged from the gas injection compressors will be piped directly to the CWP and injected down the designated injection wells. Because of the proximity of the CWP to the CPF, all injection lines will be run on VSMs or a pipe rack from the compressor area to the injection manifold.



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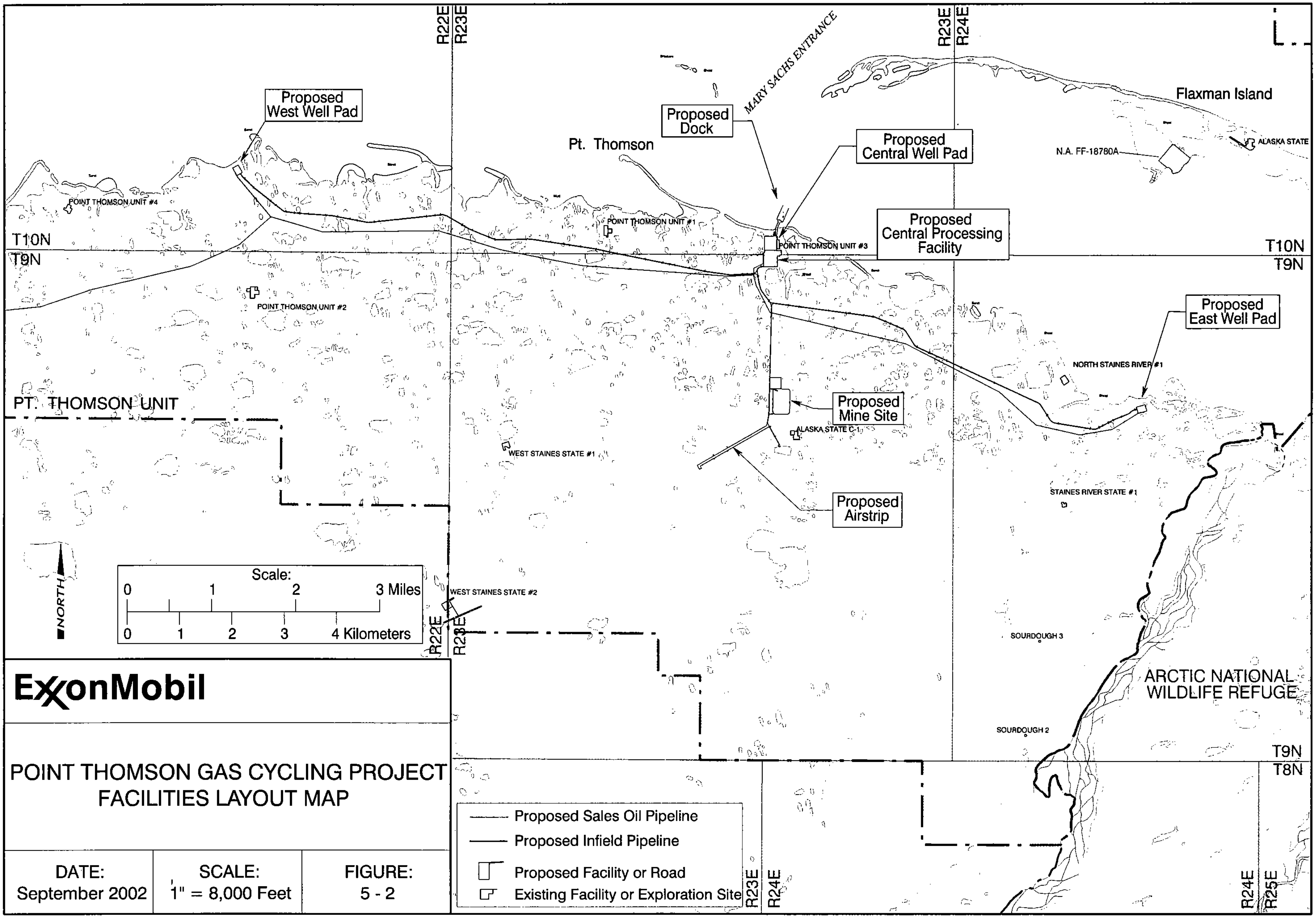
POINT THOMSON GAS CYCLING PROJECT
SIMPLIFIED FLOW DIAGRAM

DATE:	SCALE:	FIGURE:
September 2002	N/A	5-1



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POINT THOMSON GAS CYCLING PROJECT
FACILITIES LAYOUT MAP

DATE:	SCALE:	FIGURE:
September 2002	1" = 8,000 Feet	5 - 2

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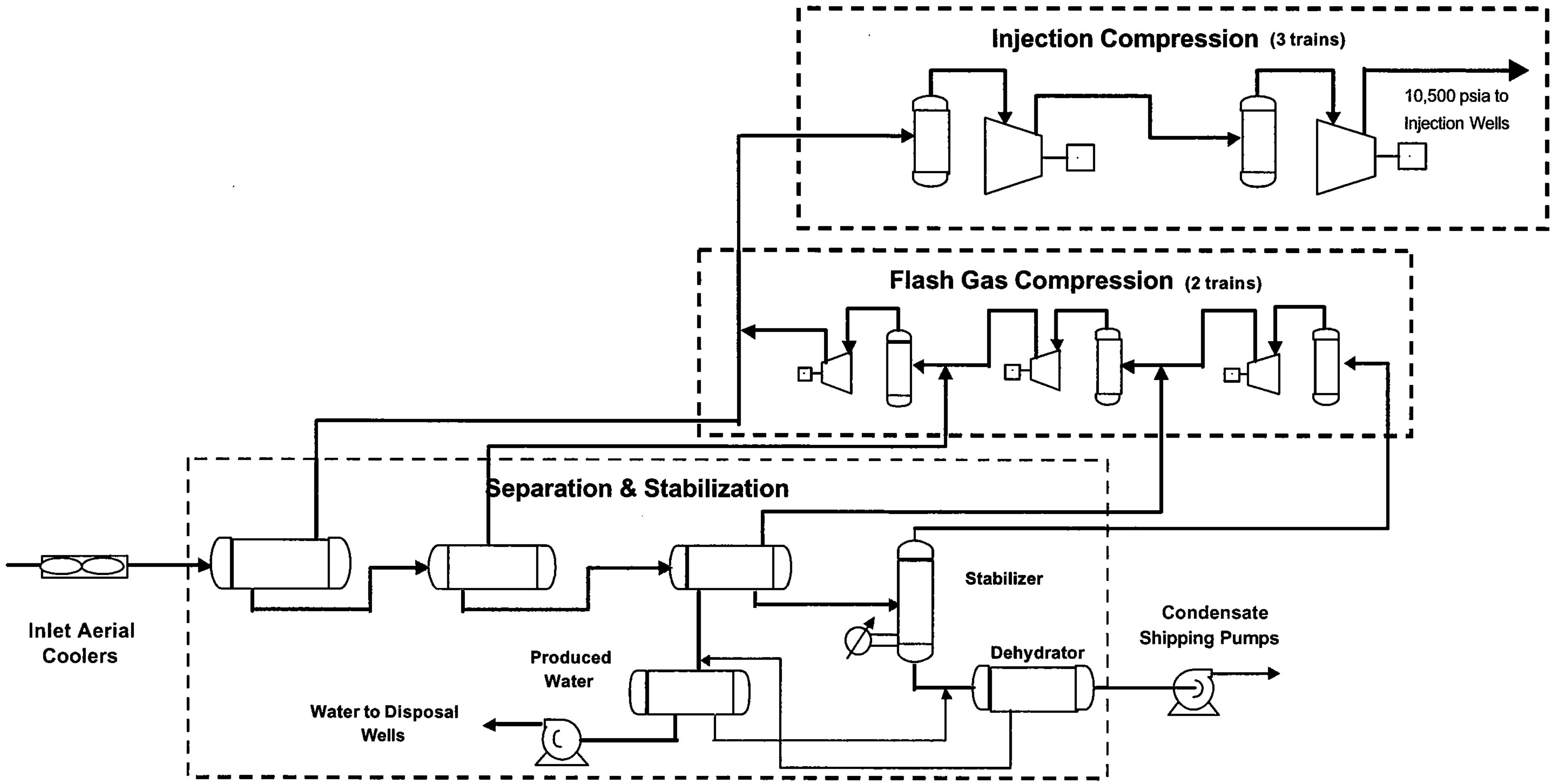

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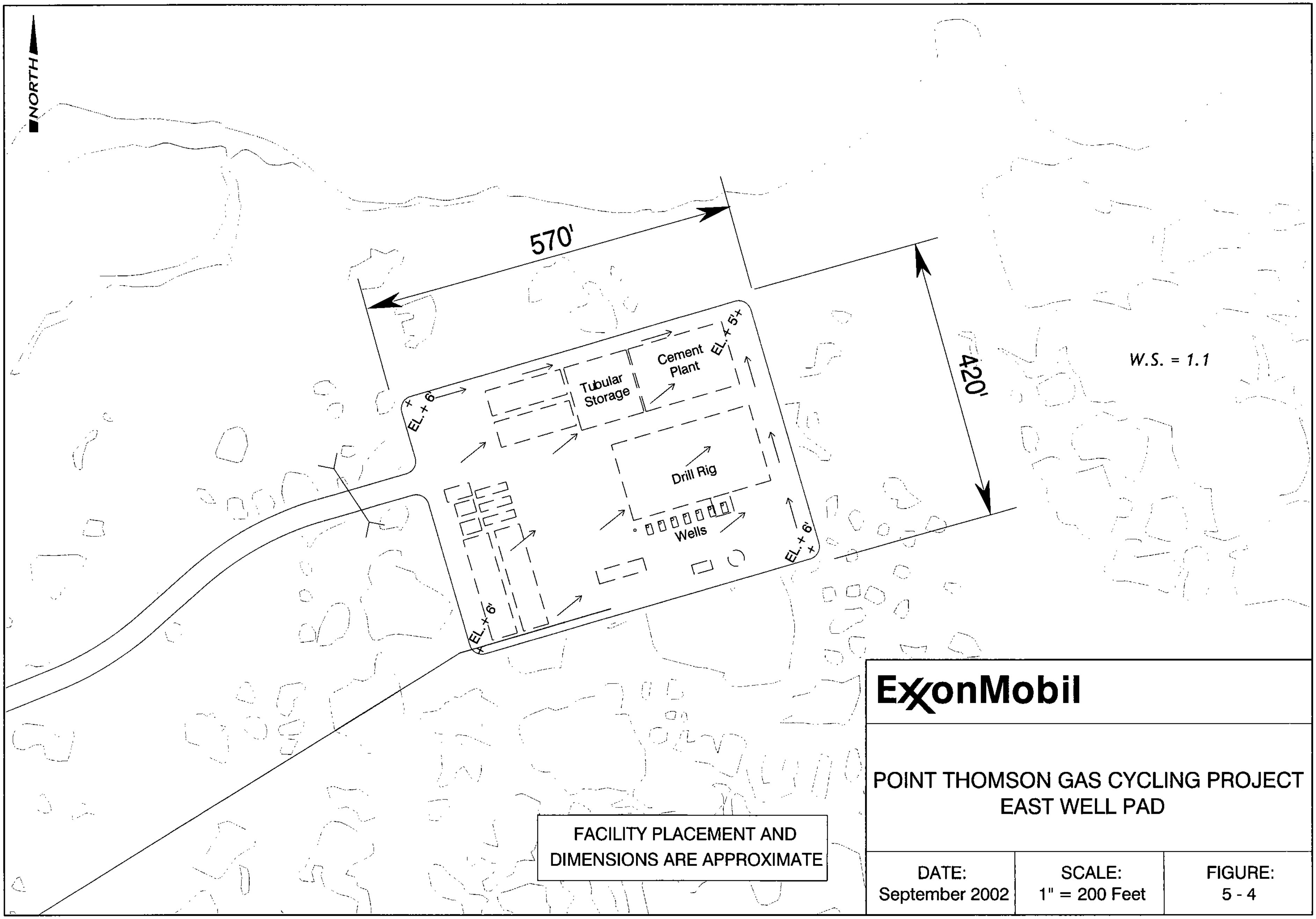
POINT THOMSON GAS CYCLING PROJECT
THREE TRAIN INJECTION CASE

DATE:	SCALE:	FIGURE:
September 2002	N/A	5-3



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POINT THOMSON GAS CYCLING PROJECT
EAST WELL PAD

DATE:	SCALE:	FIGURE:
September 2002	1" = 200 Feet	5 - 4

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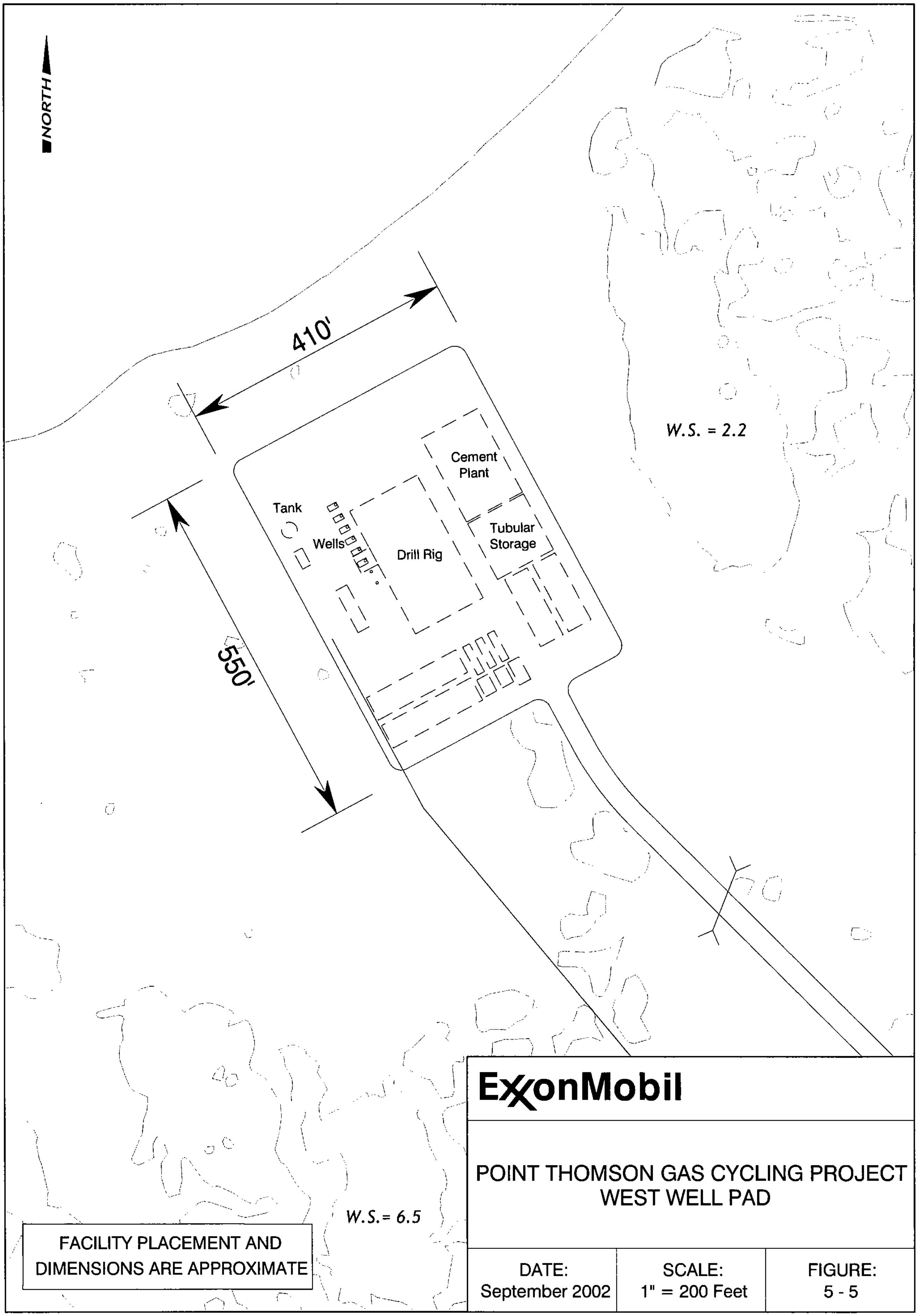

FACILITY PLACEMENT AND DIMENSIONS ARE APPROXIMATE

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POINT THOMSON GAS CYCLING PROJECT
WEST WELL PAD

DATE:	SCALE:	FIGURE:
September 2002	1" = 200 Feet	5 - 5

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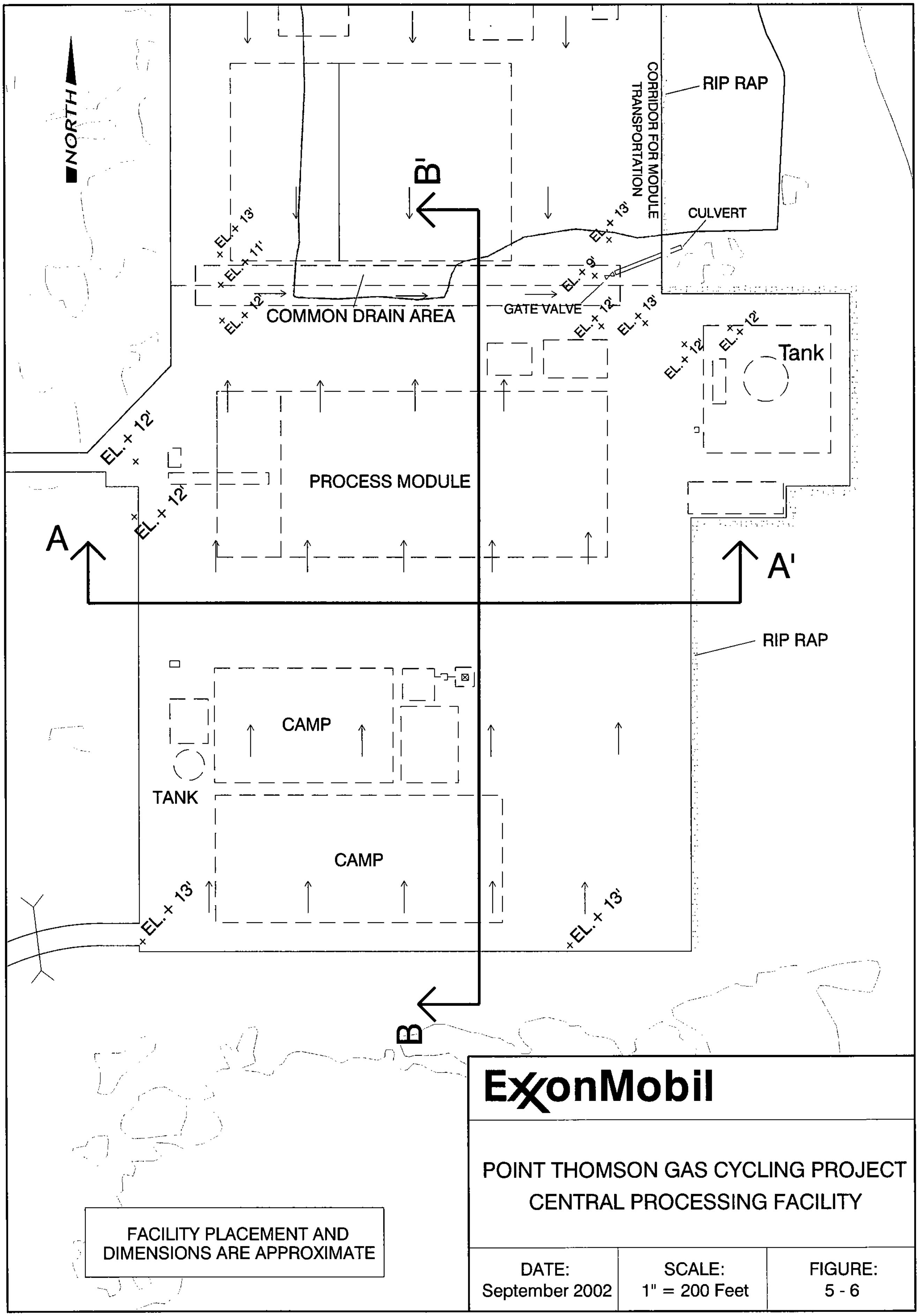

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POINT THOMSON GAS CYCLING PROJECT
CENTRAL PROCESSING FACILITY

DATE:	SCALE:	FIGURE:
September 2002	1" = 200 Feet	5 - 6

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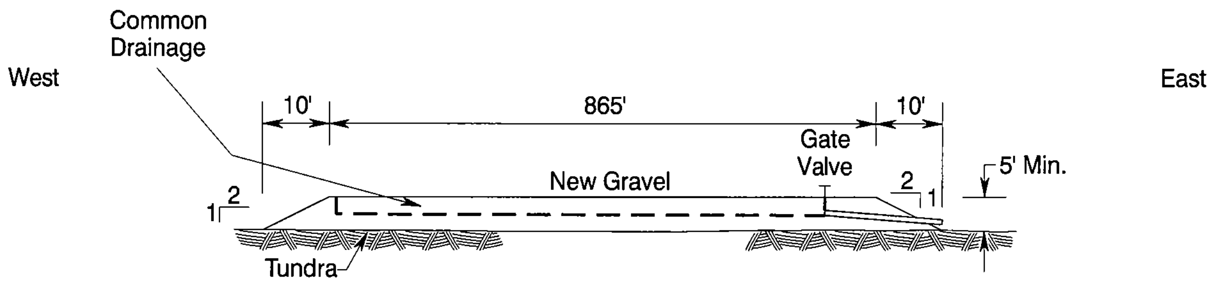
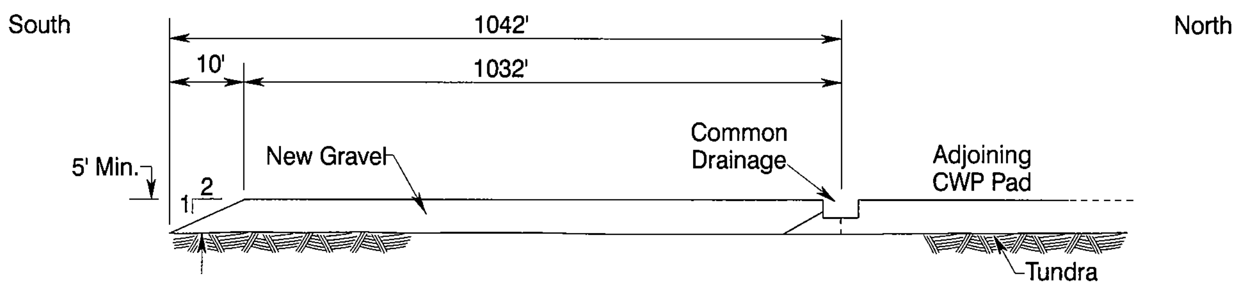


Section A - A'



Section B - B'

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POINT THOMSON GAS CYCLING PROJECT
CENTRAL PROCESSING FACILITY PAD
CROSS - SECTIONS

DATE:	SCALE:	FIGURE:
September 2002	NOT TO SCALE	5-7

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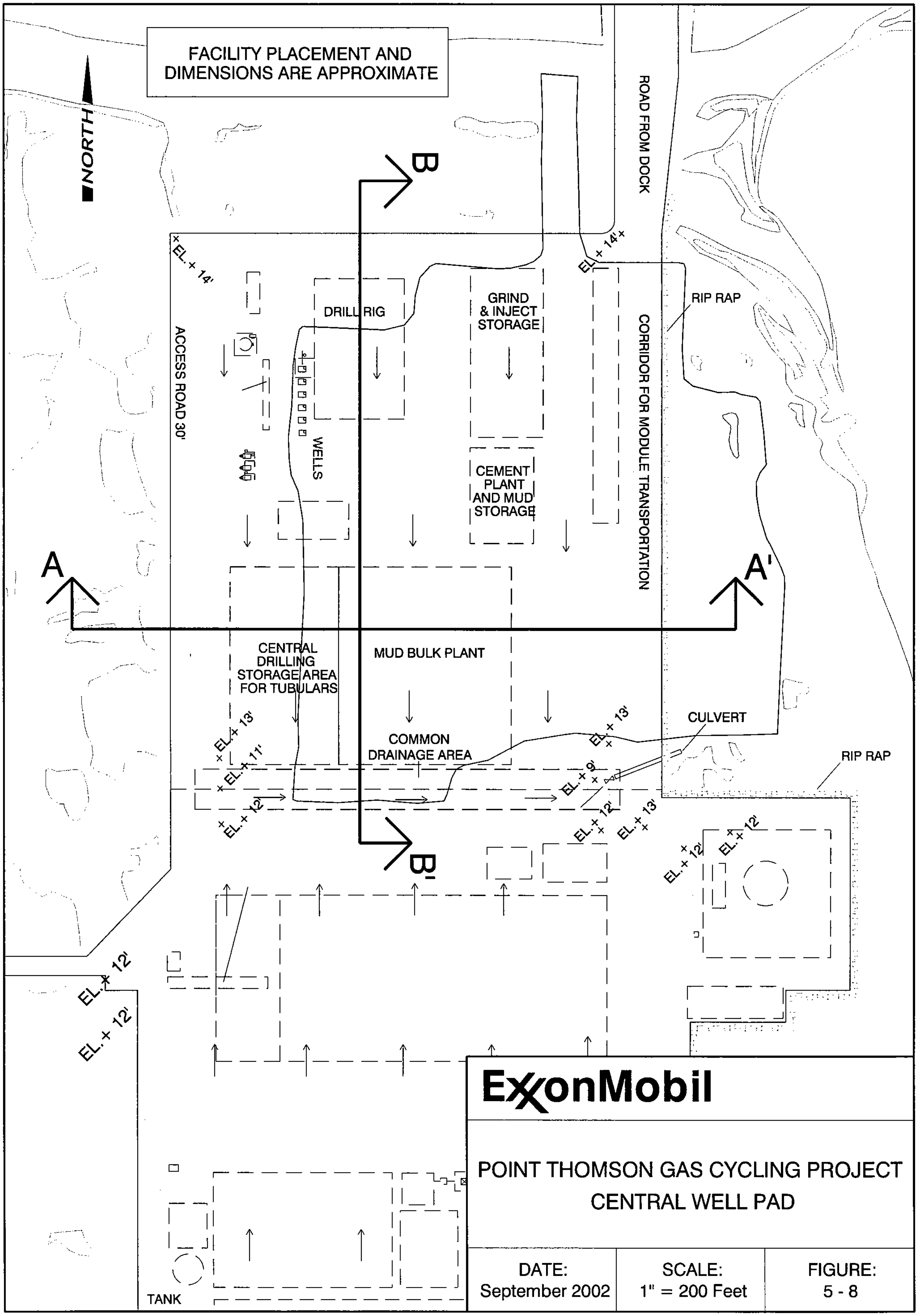

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POINT THOMSON GAS CYCLING PROJECT
CENTRAL WELL PAD

DATE:	SCALE:	FIGURE:
September 2002	1" = 200 Feet	5 - 8

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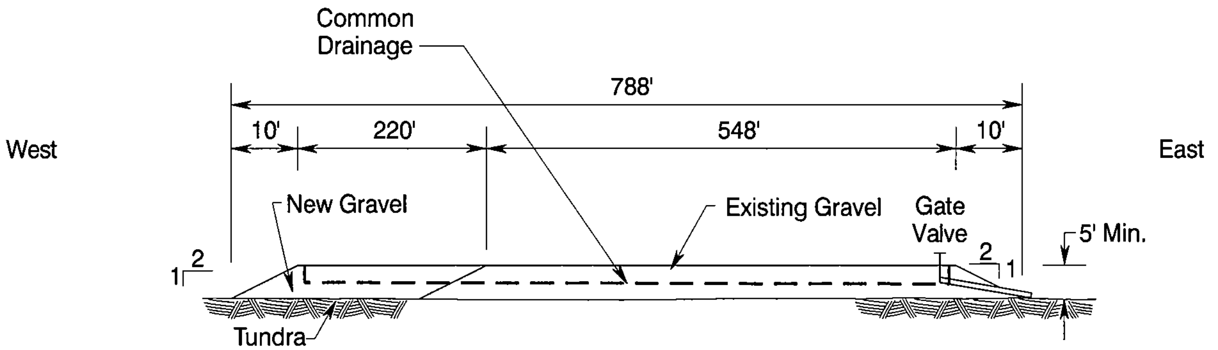

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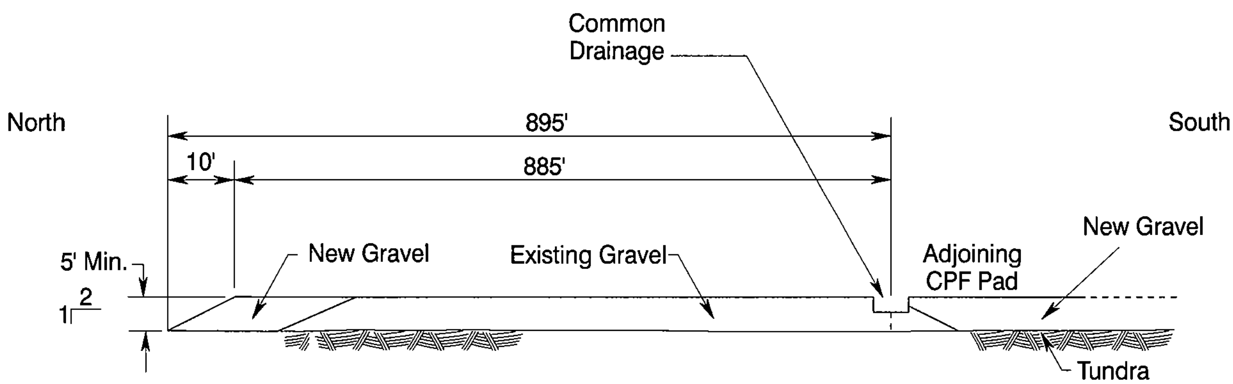

Section B - B'

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POINT THOMSON GAS CYCLING PROJECT
CENTRAL WELL PAD
CROSS - SECTIONS

DATE:	SCALE:	FIGURE:
September 2002	NOT TO SCALE	5 - 9

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6.0 EXPORT PIPELINE SYSTEM

The Point Thomson Export Pipeline will be designed, built, and operated as a common carrier system according to proven North Slope design criteria. The export system will consist of a carbon steel pipeline approximately 22 mi (35 km) long to transport condensate from the CPF to a connection point with the existing Badami pipeline. The pipeline will have a maximum allowable operating pressure (MAOP) of approximately 2,060 psi gauge (psig) [14,200 kPa]. Pig launchers and receivers will be included on this pipeline. From the tie-in point, the existing 12-in. (30.5-centimeter [cm]) Badami pipeline extends another 25 mi (40 km) to tie in with the Endicott pipeline, which extends another 10 mi (16 km) before connecting to TAPS Pump Station No. 1 at Prudhoe Bay.

The proposed Point Thomson Export Pipeline will be supported on VSMs complete with "Z" type offsets and/or expansion loops to allow for thermal effects. The VSMs will be designed and installed to provide minimum separation of 5 ft (1.5 m) between the bottom of pipe and the tundra surface. Design and installation of the VSMs will be completed using standard ExxonMobil and North Slope pipeline specifications and procedures. The VSM design will be performed during the pipeline detailed design. Table 6-1 provides the engineering data as developed to date for the export pipeline.

6.1 ROUTE SELECTION AND ROUTE

ExxonMobil's route selection process for this project incorporated the following design philosophy:

- Minimize pipeline encroachment into high-value vegetation areas.
- Minimize pipeline encroachment over small ponds and standing water.
- Minimize pipeline stream crossing by selecting those portions of the stream that are relatively narrow.
- Minimize pipeline bends.
- Share the same VSMs as the gathering pipeline between the CPF and the West Well Pad.

The route of the proposed pipeline extends about 22 mi (35 km) from the proposed CPF, located approximately 60 mi (100 km) east of Prudhoe Bay, to a point of connection with the existing Badami sales oil pipeline at the Badami Central Processing Unit (CPU). The route, as shown in Figure 6-2, starts at the CPF Pad in Section 3, T9N, R23E, and Section 34, T10N, R23E and ends at the point of connection with the existing Badami sales oil pipeline in Section 8, T9N, R20E.

TABLE 6-1
ENGINEERING DATA SUMMARY FOR THE POINT THOMSON EXPORT PIPELINE

CATEGORY	DATA
Transported Substance	Liquid hydrocarbon (condensate)
Substance Specific Gravity (@ standard conditions)	0.7 to 0.9 (water = 1.0)
Maximum Allowable Operating Pressure (MAOP)	2,060 psig (14,200 kPa)
Pipeline Outside Diameter	12.750 inches
Pipeline Wall Thickness:	**Mainline:** 0.281 inch **Station piping & valve and trap sites:** 0.375 inch
Pipe Material Grade	API 5L X65
Design Hoop Stress Factor	**Mainline:** 0.72 **Station piping & valve and trap sites:** 0.60
External Coating	**Mainline:** Polyurethane foam (PUF) insulation with galvanized metal outer jacket **Buried Road Crossings:** Fusion bonded epoxy and PUF insulation with galvanized metal outer jacket
Cathodic Protection	None
Minimum Hydrostatic Test Pressure & Duration	4 hr at minimum pressure of 125% MAOP and 4 hr at minimum pressure of 110% MAOP in accordance with U.S. Department of Transportation regulations (49 CFR, Part 195).
In-line Inspection Capability	Yes
Valves (To be determined)	**Mainline:** Automated isolation valves at the inlet and outlet of the pipeline **Check:** None
Other Facilities	
Badami Meter	Meter at Badami CPU on or adjacent to existing pad
Badami Line Heater	Heater at Badami CPU on or adjacent to existing pad
Pigging Facilities	Pig launcher facility at Point Thomson CPF and pig receiver at Badami CPU on or adjacent to existing pad.
Pumps	Pumps at the Point Thomson CPF
Point Thomson Meter	Meter at the Point Thomson CPF
Pipeline Design Maximum Throughput	100,000 bbl/day
Pipeline Design Temperatures	**Maximum:** 150°F (66°C) **Minimum:** -50°F (-46°C)
Pipeline Construction Mode(s)	**Mainline:** VSMs, minimum 5-ft (1.5-m) clearance between bottom of pipe and tundra surface **Road Crossings:** In culverts or casings through road bed gravel placed on the tundra (see Figure 6-1) **Creek and Water Crossings:** VSMs
Design Code/Regulation	49 CFR, Part 195
Minimum Operational Life	30 years

The entire length of the pipeline right-of-way (ROW) will cross lands owned by the State of Alaska. Figure 6-2 shows the approximate centerline alignment of the proposed route. The width and depth of stream or water body crossings will be determined and provided after field survey; however, all stream and water body crossings from Point Thomson CPF to the Badami tie-in will be constructed above-grade using VSMs. No below-grade river or stream crossings are planned, nor are they necessary because the streams traversed by the pipeline are small.

6.2 PIPELINE MATERIAL

As shown on Table 6-1, API 5L X65 pipe material will be used for the pipeline.

6.3 PIPELINE CAPACITY

As shown on Table 6-1, the pipeline is presently designed for a maximum throughput of 100,000 bbl/day.

6.4 PIPELINE INTEGRITY MONITORING SYSTEM

The proposed pipeline design will include a computational leak detection system in accordance with federal and state requirements. The system will perform real-time monitoring for pipeline leakage and will likely rely on operating data such as liquid hydrocarbon flow and pressure meter data. Meters will be provided on each end of the export pipeline (i.e., one at the CPF and one at the tie-in to the Badami pipeline). This information will be used to compute mass-balance calculations that will be able detect a leak volume at least 1% of the daily throughput. The operating data will be continually updated, gathered from field instruments, and compiled in the host computer via the supervisory control and data acquisition (SCADA) system. Specific hardware and software options for the leak detection system will be evaluated and selected later in project design.

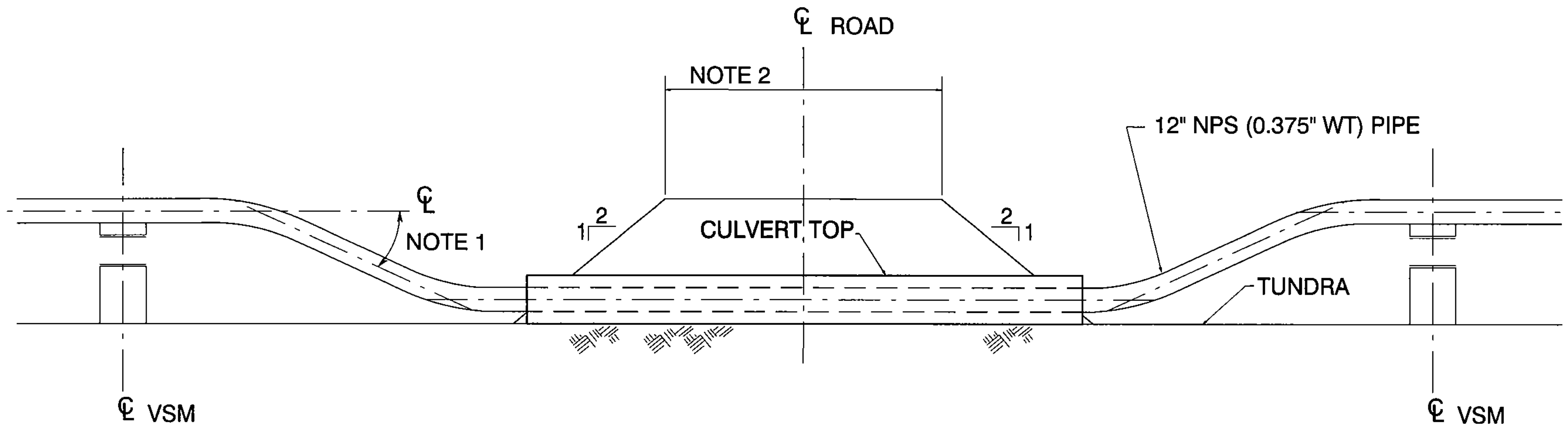
Mainline valves will be installed at the pipeline inlet and outlet in accordance with the requirements of 49 Code of Federal Regulations (CFR), Part 195. In-line mainline valves or vertical loops, which will be evaluated and defined during preliminary design, may be installed to limit the amount of the condensate that can be spilled in the event of a pipeline leak or rupture. Shutdown procedures will be developed to meet regulatory and industry standards.

Pig launchers and receivers will be installed, and pipeline operations will include periodic in-line inspections using intelligent pigging tools to collect baseline and subsequent data sets for monitoring the condition of the pipeline over its operating life.

As discussed in Section 12, the Point Thomson ODPCP will be developed and implemented in accordance with Alaska Department of Environmental Conservation regulations (18 AAC 75), which include plans for prevention of and response to any spills of oil, fuel or other substances. The ODPCP will provide specific spill containment and prevention measures, equipment needs, and response strategies. This ODPCP will address oil spill prevention and response to protect public health and safety during pipeline operation. Measures to protect public health and safety during pipeline operation include an ongoing inspection and maintenance program.

6.5 CORROSION MANAGEMENT

An internal protective coating is not necessary for the pipeline because condensate transported in the line will have low water and sulfur contents and thus would not cause corrosion of the inside wall of the pipelines. The addition of corrosion inhibitors to the fluid streams may be considered if required by the ultimate fluid properties and operating conditions. Cathodic protection for external corrosion control was not considered because above-ground pipelines do not require it.



TYPICAL CROSS SECTION OF ROADWAY CROSSING

NOTES:

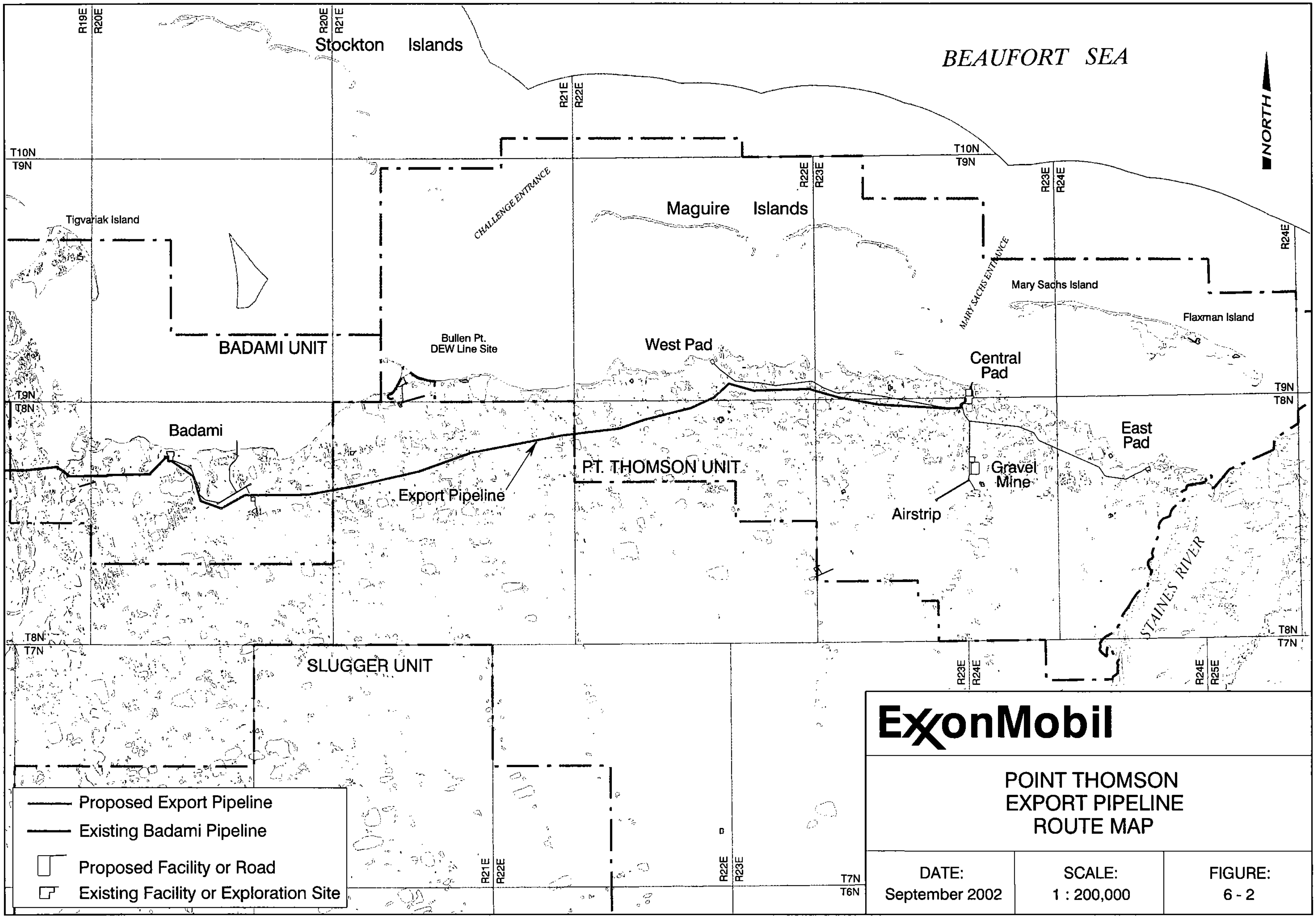
1. Exact angles to be determined during detailed design, based on topography and the location and height of nearest VSM.
2. Exact distance to be determined during detailed design.

ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
EXPORT PIPELINE
TYPICAL ROAD CROSSING

DATE:	SCALE:	FIGURE:
September 2002	Not to Scale	6 - 1

Ex14464cross.dgn



BEAUFORT SEA
NORTH
Stockton Islands
Maguire Islands
Tigvariak Island
CHALLENGE ENTRANCE
MARY SACHS ENTRANCE
Mary Sachs Island
Flaxman Island
BADAMI UNIT
Bullen Pt.
DEW Line Site
West Pad
Central Pad
East Pad
Badami
PT. THOMSON UNIT
Export Pipeline
Gravel Mine
Airstrip
STAINES RIVER
SLUGGER UNIT
T10N
T9N
T8N
T7N
T6N
R19E
R20E
R21E
R22E
R23E
R24E
R25E
Proposed Export Pipeline
Existing Badami Pipeline
Proposed Facility or Road
Existing Facility or Exploration Site
ExxonMobil
POINT THOMSON
EXPORT PIPELINE
ROUTE MAP
DATE:
September 2002
SCALE:
1 : 200,000
FIGURE:
6 - 2

fig6_2.dgn

7.0 INFRASTRUCTURE AND CIVIL WORKS

This section includes descriptions of the transportation and support facilities required by the proposed project. Section 7.1 discusses the temporary road systems (sea-ice and land-based ice roads), as well as a temporary construction camp. Section 7.2 covers permanent facilities such as gravel roads, pads, an airstrip, and dock as well as the gravel sources and gravel stockpile required for construction. Infrastructure facilities such as a permanent camp, warehouse, diesel storage areas, telecommunications, freshwater sources, and electrical power facilities are presented in Section 7.3.

7.1 CONSTRUCTION-RELATED INFRASTRUCTURE

7.1.1 Sea-Ice Road

During the two winter-construction seasons, a sea-ice road will be built following the shoreline to Point Thomson from the existing permanent road system at Endicott. The ice road will be approximately 42 mi (68 km) in length and will consist primarily of seawater ice, with an option to cap the road with freshwater ice. The sea-ice road will be built for the 2005 and 2006 winter-construction seasons and for drilling resupply (as described in Section 10). Depending on special activities and related logistics, a sea-ice road may be constructed on occasion once the facilities are in operation. During the drilling and construction phase of the project, the sea-ice road will be used to transport heavy equipment, materials, and supplies. The general route for the ice road is shown on Figure 7-1. During the second season, the ice road may tie into the West Well Pad in order to reduce the road's length. This will depend on activities that may be occurring at the West Well Pad during this period.

7.1.2 Land-Based Ice Roads

Ice roads situated on land (typically tundra) will be required during the first two construction seasons. During the first winter, one road approximately 3 mi (5 km) long will extend south from the general location of the CWP, past the proposed gravel mine site, to the freshwater source at the former gravel mine (Figure 7-2). During the second winter, land-based ice roads will be required along the pipeline right-of-way to provide the travel and construction working surface for the export pipeline and gathering lines. Figures 7-3 and 7-4 show the proposed route of pipeline-construction ice roads from the East Well Pad to the CPF (about 6 mi [9.7 km]), the CPF to West Well Pad (about 7 mi [11 km]), and the West Well Pad to Badami (about 16 mi [26 km]). The width of an ice road for pipeline construction is generally about 100 ft (30.5 m); however, it may be widened in select areas for materials storage or to provide access to other project-related activities. Also, spur ice roads may be constructed to the sea-ice road at appropriate locations to improve access and travel times.

7.1.3 Construction Camp

The construction camp will be a self-contained unit with its own utility services such as water and wastewater treatment. The camp may be leased from the existing North Slope inventory or purchased and then sold at a later date. The camp will be trucked to the site in stages as required on sea-ice roads. The construction camp will be built in stages to support the ultimate projected peak capacity of 450 people. The construction workforce is expected to peak during the first quarter of 2006, with simultaneous drilling operations, pipeline construction, and other construction works at the various locations. Should actual workforce requirements exceed the combined capacity of the construction and permanent camp facilities, the Badami construction camp may serve as overflow contingency along with other available facilities in the Deadhorse area.

There are currently no plans to locate field camps along the pipeline route during pipeline construction. Warm-up shacks and onsite toilet facilities will be installed along the pipeline construction right-of-way prior to and during pipeline construction and will be removed once construction is complete.

7.2 CIVIL WORKS

7.2.1 Permanent Gravel Roads

Permanent all-weather gravel roads are required within the Point Thomson Unit to connect the project well pads, airstrip, gravel mine, and freshwater supply source(s) to the centrally located CPF Pad (Figure 7-3). In addition, a gravel roadway will extend from the dock to the CPF Pad. These permanent roads, along with the production and facility pads, and the airstrip will be constructed mostly during the winter from locally mined gravel. Gravel roads for vehicle traffic will be nominally about 30 ft to 35 ft (9 m to 11 m) wide. However, the road from the dock to the CPF Pad will be about 50 ft (15 m) wide to facilitate movement of the large, heavy facility modules brought in by a sea lift.

The minimum permitted footprint for roads, pads, and the airstrip must have the dimensions of the finished surface plus an approximately 10-ft (3-m) wide shoulder per side to account for the side slopes. An additional buffer area around the entire footprint perimeter (i.e., beyond the traveled surface plus side slopes) will also be included in the permitted area for construction. This buffer area is necessary because, despite maintenance, material will invariably spread beyond the toe over time due to the steepness of the side slopes. Table 7-1 summarizes the design details for the various gravel roads, and Figure 7-5 depicts typical gravel road cross-sections. This information could change as engineering and project execution plans develop.

The gravel roads will cross creeks and small tundra streams, and culverts or bridges will be used at these crossings. The design selected will depend on the width of the stream and discharge flow parameters at the site of each road crossing. For the smaller streams, both culverts and "mini-span" bridges will be considered. Figures 7-6 through 7-9 depict half-pipe configurations that will be used for typical large stream crossings. For small drainages, 18-in. (46-cm) steel culverts will be installed. The specific design will be selected for each water body crossing as engineering design progresses.

TABLE 7-1
SUMMARY OF GRAVEL ROADS

ROAD	DESCRIPTION	APPROXIMATE DIMENSIONS
CPF to AIRSTRIP[1]	Length	1.4 mi (2.3 km)
	Width	30 ft (9 m)
	Gravel Quantity	67,000 cubic yards (cy) (51,200 m^3)
	Year Constructed	First winter
ABANDONED MINE SITE ROAD[1]	Length	0.26 mi (0.4 km)
	Width	30 ft (91 m)
	Gravel Quantity	15,000 cy (11,500 m^3)
	Year Constructed	First winter
CPF to EAST WELL PAD	Length	5.7 mi (9.1 km)
	Width	35 ft (11 m)
	Gravel Quantity	305,000 cy (233,000 m^3)
	Year Constructed	First winter
CPF to WEST WELL PAD	Length	6.6 mi (10.6 km)
	Width	35 ft (11 m)
	Gravel Quantity	365,000 cy (280,000 m^3)
	Year Constructed	First winter
CPF to DOCK (Functional part of the CPF & CWP)	Length	0.3 mi (0.5 km)
	Width	50 ft (15 m)
	Gravel Quantity	20,000 cy (15,300 m^3)
	Year Constructed	First winter

[1]Gravel volume includes spur roads to mine site, gravel storage pad, and abandoned mine site.

7.2.2 Airstrip

An airstrip that is operational on a year-round basis is essential for the safety of plant operators as well as for emergency response. The airstrip will provide the only year-round access to Point Thomson because the project is remote and isolated from existing facilities and the public and private road systems associated with Prudhoe Bay. Additionally, an airstrip provides a means of transporting people, supplies, equipment, and materials during those periods when access is not possible by either ice road or barge. The proposed location of the airstrip is approximately 2 mi (3.2 km) from the coast, south of the CPF Pad. Factors considered in the location were:

- Proximity to CPF and camp facilities,
- Location sufficiently south of the coast to minimize fog restrictions,
- Alignment with prevailing winds,
- Topography,
- Proximity to a gravel source,

- Avoidance of any creeks or lakes, and
- Proximity to existing access roads.

The location of the airstrip is shown on the facilities layout (see Figure 5-2) and details of its design are provided on Figures 7-10 through 7-12. It is anticipated that the airstrip will become operational by mid- to late-summer following its construction.

During operations, the types of aircraft using the strip most frequently for bringing in crew changes and supplies will be the size of a Twin Otter. However, for maintenance and servicing of large equipment, the runway will be designed and built to provide landing and take-off capabilities for a fully loaded Hercules C-130. For potentially larger crew changes during the construction phase and for emergency evacuation of personnel, the airstrip will be adequate for safe landing and takeoff for a Boeing 737 jet aircraft. The proposed airstrip will be sized to satisfy all applicable laws, regulations and project requirements for regular use by Twin Otters, Hercules C-130, and Boeing 737 aircraft. The proposed airstrip will also include the following features:

- Turn-around locations at each end measuring approximately 150 ft by 300 ft (45 m by 90 m);
- An all-weather road to the CPF Pad;
- A 10-ft by 20-ft (3-m by 6-m) airport control building;
- Electrical service via cable buried in the road from the CPF power-generating facilities;
- Control and communication links to the CPF using fiber-optic cable; and
- Navigation and communication controls and an instrument approach system that provides 24-hour operation under conditions with a minimum 0.5-mi (0.8 km) visibility and a 200-ft (61-m) ceiling.

As with gravel roads, the minimum permitted footprint for the airstrip must have the dimensions of the finished surface plus an approximately 10-ft (3-m) wide shoulder per side to account for the side slopes. An additional buffer area around the entire footprint perimeter (i.e., beyond the traveled surface plus side slopes) will also be included in the permitted area for construction. This buffer area is necessary because, despite maintenance, material will invariably spread beyond the toe over time due to the steepness of the side slopes.

7.2.3 Dock

Facilities and logistics studies completed to date indicated that the dock is a necessary component of the project, and must be capable of landing barges transporting the CPF modules weighing up to 6,000 tons (5,443 metric tons). This weight specification and the associated barge configuration require approximately a 9-ft (2.7-m) water depth.

The dock will be an armored gravel-fill structure 750 ft (229 m) long by 100 ft (30 m) wide (Figure 7-13). The dockhead will be 150 ft by 100 ft (46 m by 30 m), complete with sheet piling, cell walls, fenders, bollards, and face beams (Figures 7-14 and 7-15). It is anticipated that approximately 100,000 cubic yards (cy) (76,500 m^3) of gravel will be required to construct the dock. During 2005 and/or 2006, a sea lift will ship the CPF modules to the project area, and thus a channel will likely be established from the dockhead to the 9-ft (2.7-m) isobath. The channel area, as depicted in Figure 7-14, is estimated to be approximately 1,000 ft by 400 ft (305 m by 122 m).

7.2.4 Pads

The Point Thomson Gas Cycling Project will require gravel pads to support production and gas injection wells, process facilities, a permanent camp, and gravel storage (Figure 5-2). The location of the pads in the Point Thomson Unit is based on a combination of environmental considerations and the need to reach bottom-hole targets in the Thomson Sand reservoir. Production wells will be situated on two pads: the East Well Pad and the West Well Pad. The CWP will support gas injection and waste disposal wells, and another pad will serve as a location for the CPF and all related infrastructure, support equipment, and required services. Surface drainage on these pads will be designed to control storm water runoff. A fifth pad will be located next to the gravel mine where gravel will be stockpiled for future maintenance needs. Table 7-2 provides a summary of the dimensions, gravel requirements, and features of each gravel pad; however, the final design is likely to change as engineering design matures.

TABLE 7-2
SUMMARY OF GRAVEL PADS

PAD	DESCRIPTION	APPROXIMATE SIZES
EAST WELL PAD	Size (L x W)	570 ft x 420 ft (174 m x 128 m)
	No. of Wells	7 production and space for 2 future wells
	Gravel Volume	56,000 cy (43,000 m^3)
	Year of Construction	First winter
WEST WELL PAD	Size (L x W)	550 ft x 410 ft (167 m x 125 m)
	No. of Wells	6 production and space for 2 future wells
	Gravel Volume	53,000 cy (40,500 m^3)
	Year of Construction	First winter
CENTRAL WELL PAD (includes portions of the 50-ft Dock Road)	Size (L x W)	885 ft x 768 ft (270 m x 234 m)
	No. of Wells	8 injection, 1 disposal, and space for 2 future wells
	Gravel Volume	155,000 cy (119,000 m^3)
	Year of Construction	First winter
CPF PAD (includes portions of the 50-ft Dock Road)	Size (L x W)	1,030 ft x 885 ft (313 m x 270 m)
	No. of Wells	N/A
	Gravel Volume	238,000 cy (181,000 m^3)
	Year of Construction	First winter
GRAVEL STORAGE PAD/ MAINTENANCE STOCKPILE	Size (L x W)	700 ft x 700 ft (213 m x 213 m)
	Gravel Volume	250,000 cy (191,000 m^3)
	Year of Construction	First winter

7.2.5 Gravel Sources

A new gravel mine site approximately 2 mi (3.2 km) south of the CPF will be the primary gravel source for the Point Thomson Gas Cycling Project. A geotechnical survey at this centrally located site identified gravel of sufficient quantity and quality for construction use.

It is anticipated that approximately 2,000,000 cy (1,530,000 m^3) of gravel and 470,000 cy (360,000 m^3) of tundra overburden will be removed from the 39-acre (16-ha) mine site. The site will be located approximately 220 ft (67 m) east of the CPF/Airstrip infield road and connected with this road by a short (220 ft [67 m]) access road located at the extreme north end of the mine site. Figures 7-16 and 7-17 show the plan view and cross-section of the proposed gravel mine site, respectively. A mine site rehabilitation plan will be developed based refinement of an existing draft. Once gravel extraction is completed, it is anticipated that the mine site will fill with water during spring breakup and provide an additional freshwater source for project use.

7.2.6 Maintenance Gravel Stockpile

A gravel stockpile will be required for maintenance of gravel roads and pads. This stockpile will be created during the gravel mining operation and before flooding of the mine site. The stockpile is anticipated to be approximately 250,000 cy (191,000 m^3), which should be enough to maintain the project road and pad system. Historically, this need has been estimated to be 10% to 15% of the total gravel requirement for the project.

A secondary use of the large gravel surface provided by the stockpile is to serve as a storage area, particularly during the drilling phase of the project. The gravel storage pad will be immediately adjacent to and north of the proposed mine site, with the west side of the pad adjoining the CPF/airstrip infield road. The gravel storage pad will cover approximately 11 acres (4.5 ha).

7.3 INFRASTRUCTURE AND SUPPORT FACILITIES

7.3.1 Permanent Camp

The permanent camp will be designed and built to accommodate 100 people at various times throughout the construction and operation phases. The camp will include a kitchen, laundry, recreational facilities, and sleeping quarters. Water supply and sewage treatment for the camp will be provided either through a separate utility module or will be integrated into the camp.

A utility module supporting camp operations is planned to contain the potable water treatment system, the sewage treatment system, the firewater pumps, and the incinerator for the permanent camp and the plant facility. This utility module will also contain a potable water storage tank for camp use. Gray water from the plant sewage treatment system will be disposed of in the disposal well once that well is operational.

A raw water storage tank will accompany the camp utility module and serve as the source for the camp potable water and firewater. This tank and associated instrumentation will be heat-traced and insulated to avoid damage during freezing weather. Water tanks will be refilled with local surface water collected either by truck or via a water supply pipe from two area gravel-mine sites (i.e., an existing mine site and the new mine site, both located about 2 mi [3 km] south of the CPF).

7.3.2 Warehouse

The warehouse will provide a dry and warm storage area, a rig maintenance area, a vehicle maintenance area, and individual maintenance areas for electrical, instrumentation, and mechanical support. Other temporary structures may be erected on site for maintenance and storage functions. Presently, the warehouse is planned as an insulated rigid-frame metal building. The warehouse floor will be a cast-in-place concrete slab at grade.

7.3.3 Water Sources

Figure 7-18 shows the potential water-source lakes for ice road construction and other activities. Table 7-3 summarizes the conceptual estimate of anticipated water quantities and sources required for the Point Thomson project construction and operation. Additional work is presently being completed to refine information on water-source availability and on recharge of water sources, and to identify project water needs. Table 7-4 provides previously permitted volumes for water sources used for earlier activities in the Point Thomson area and developments to the west.

TABLE 7-3
POINT THOMSON WATER USE –
CPF FACILITY CONSTRUCTION AND OPERATION

ACTIVITY	ITEM	ESTIMATED WATER QTY (GALLONS)	POTENTIAL SOURCE(S)
Ice Roads	2005 sea-ice road cap[2]	33,180,000	3,870,000 gallons (gal) from source(s) in the vicinity of the Point Thomson CPF and West Well Pad; 14,310,000 gal from source(s) in the vicinity of the Badami CPU; and 15,000,000 gal from source(s) in the vicinity of the Endicott causeway landfall.
	Point Thomson dock-to-mine site ice road construction[3]	1,480,000	Existing Point Thomson gravel mine site and shallow lakes between the Point Thomson dock and mine site.
	Spur ice roads to water sources[4]	11,390,000	6,000,000 gal from source(s) in the vicinity of the CPF and production well pads; and 5,390,000 gal from source(s) in the vicinity of the Badami CPU.
	2005 maintenance[5]	3,780,000	380,000 gal from source(s) in the vicinity of the CPF and production well pads; 1,400,000 gal from source(s) in the vicinity of the Badami CPU; and 2,000,000 gal from source(s) in the vicinity of the Endicott causeway landfall.

ACTIVITY	ITEM	ESTIMATED WATER QTY (GALLONS)	POTENTIAL SOURCE(S)
Ice Roads (Cont'd)	2006 sea-ice road cap[2]	33,180,000	3,870,000 gal from source(s) in the vicinity of the CPF and West Well Pad; 14,310,000 gal from source(s) in the vicinity of the Badami CPU; and 15,000,000 gal from source(s) in the vicinity of the Endicott causeway landfall.
	Pipeline right-of-way ice road construction[6]	40,330,000	20,000,000 gal from source(s) in the vicinity of the CPF and the East and West Well Pads; and 20,330,000 gal from source(s) in the vicinity of the Badami CPU.
	Spur ice roads to water sources[4]	11,390,000	6,000,000 gal from source(s) in the vicinity of the CPF and production well pads; and 5,390,000 gal from source(s) in the vicinity of the Badami CPU.
	2006 maintenance[7]	7,560,000	760,000 gal from source(s) in the vicinity of the CPF and production well pads; 2,800,000 gal from source(s) in the vicinity of the Badami CPU; and 4,000,000 gal from source(s) in the vicinity of the Endicott causeway landfall.
Drilling & Construction[8]	2005 drilling[9]	10,620,000	Source(s) in the vicinity of the CPF and production well pads.
	2006 drilling[10]	19,470,000	Source(s) in the vicinity of the CPF and production well pads.
	2007 drilling[11]	8,850,000	Source(s) in the vicinity of the CPF and production well pads.
	Drilling fluid and cuttings disposal	N/A	Not applicable
	2005 temporary construction camp[12]	8,760,000	Source(s) in the vicinity of the CPF.
	2006 temporary construction camp[12]	14,600,000	Source(s) in the vicinity of the CPF.
	2007 temporary construction camp[12]	5,480,000	Source(s) in the vicinity of the CPF.
	Camp waste disposal	N/A	Not applicable
	VSM setting slurry	170,000	Source(s) in the vicinity of the CPF or the West Well Pad.
Hydrostatic Testing	Gathering pipeline hydrostatic testing, summer/fall program[13]	550,000	Source(s) in the vicinity of the CPF and production well pads, accessible from the pads or access roads.
	Condensate export pipeline hydrostatic testing, summer/fall program[13]	720,000	Source(s) in the vicinity of the Badami CPU pad, accessible from the pads or access roads.
	Well pad and CPF piping and vessel testing	30,000	Source(s) in the vicinity of the CPF and production well pads, water will be blended with glycol to form a 60:40 mixture.

ACTIVITY	ITEM	ESTIMATED WATER QTY (GALLONS)	POTENTIAL SOURCE(S)
Commissioning	Fire water storage tank charge	510,000	Source(s) in the vicinity of the CPF.
	Potable water system initial charge	10,000	Source(s) in the vicinity of the CPF.
	Glycol heating and cooling systems initial charge, etc.	10,000	Source(s) in the vicinity of the CPF.
Operation	Permanent camp potable water, 10,000 gal/day[14]	N/A	Point Thomson gravel mine sites.
	CPF facility make-up water, 500 gal/year	N/A	Point Thomson gravel mine sites.
2005 Totals	Water use	69,210,000	30,000,000 gal from source(s) in the vicinity of the CPF and production well pads; 24,210,000 gal from sources in the vicinity of the Badami CPU; and 15,000,000 gal from source(s) in the vicinity of the Endicott causeway landfall.
	20% contingency volume	13,840,000	Same as above.
	Total	83,050,000	
2006 Totals	Water use	128,530,000	65,000,000 gal from source(s) in the vicinity of the CPF and production well pads; 46,530,000 gal from sources in the vicinity of the Badami CPU; and 17,000,000 gal from source(s) in the vicinity of the Endicott causeway landfall.
	20% contingency volume	25,700,000	Same as above.
	Total	154,230,000	
2007 Totals	Water use	14,330,000	All from source(s) in the vicinity of the CPF and production well pads.
	20% contingency volume	2,900,000	Same as above.
	Total	17,230,000	
Operations Totals	Water use	N/A	10,000 gal/day from the Point Thomson gravel mine site or other sources in the area.

Table 7-4 Notes:

1. Sources in the vicinity of the Pt. Thomson CPF include permitted Unnamed Lake and Pt. Thomson Old Mine Site as well as possible future permitted sources. Sources in the vicinity of Badami CPU include permitted Shaviovik Pit, Turkey Lake, and Badami Reservoir as well as possible future permitted sources. Sources in the vicinity of the Endicott causeway landfall include Duck Island Mine Site and Sag Mine Site C (Vern Lake) as well as possible future permitted sources.
2. Sea-ice road cap is nominally 40 ft wide, 6 in thick and made from pure fresh water (790,000 gallons per mile [gal/mi] by 42 mi long).
3. Dock-to-mine-site ice road is nominally 40 ft wide and 6 in thick, standard North Slope ice road construction from snow and fresh water (569,100 gal/mi by 2.6 mi long).
4. Spur roads to water sources will be nominally 40 ft wide and 6 in thick, standard North Slope ice road construction from snow and fresh water (569,100 gal/mi by 20 mi total length).
5. 90-day maintenance period, 42,000 gal applied per day.

6. Pipeline right-of-way ice roads are nominally 100 ft wide and 6 in thick, standard North Slope ice road construction from snow and fresh water (1,430,000 gal/mi by 28.2 mi total length).
7. 90-day maintenance period, 84,000 gal applied per day.
8. Water quantity for drilling includes sufficient water for the water-based drilling fluid, casing cement and operation of the G&I system for cuttings and drilling fluid disposal.
9. 3 wells at 1,770,000 gal fresh water per well.
10. 6 wells at 1,770,000 gal fresh water per well.
11. 4 wells at 1,770,000 gal fresh water per well.
12. 100 gal per day per person, average camp occupancy: 240, 400 and 150 persons in 2005, 2006 and 2007, respectively.
13. Hydrostatic testing could be conducted in the summer and fall following construction in which case access to the pipeline will not exist except at the trap and valve sites (i.e., located on pads). Pure fresh water would be used for testing and would be discharged onto the tundra following appropriate filtration and diffusion. Alternatively, the testing program could proceed in March and April, immediately after the pipelines are constructed in which case the ice roads would still be in place and ambient temperature would still be sub-freezing. A 60:40 water/glycol mixture would be used for testing and would be recovered and hauled to an approved facility for disposal or reuse upon completion of testing.
14. 100 gal per day per person, maximum camp occupancy 100 persons.

TABLE 7-4
EXAMPLE PERMITTED VOLUMES FOR WATER SOURCES IN THE POINT THOMSON AREA AND TO THE WEST

WATER SOURCE	GENERAL LOCATION	CURRENT/ PAST BPXA PERMIT #	PERMITTED VOLUME TOTAL FOR ALL SOURCES (CURRENT OR PAST)	ESTIMATED VOLUME (GAL)	ADF&G RESTRICTIONS?	COMMENTS
Duck Island Mine Site	Endicott Road	LAS 13290	221 acre-ft per year (72,000,000 gal)	600,000,000	Yes	Past permitted volumes based on need rather than availability
Sag Mine Site C (Vern Lake)	Endicott Road	LAS 13629		792,000,000	Yes	
Badami Reservoir	Badami Development	LAS 19045	61.6 acre-ft per year (20,000,000 gal)	86,000,000	Yes	Drinking water source
Turkey Lake	South of Badami CPU			730,000	No	Relatively shallow lake
Shaviovik Pit	Shaviovik River Delta, west of Badami CPU	LAS 14042	1125.27 acre-ft per year (370,000,000 gal)	125,000,000	No	Typically used in ice roads to Badami
Point Thomson Old Mine Site	Point Thomson Unit development area			104,000,000	Unknown	
Unnamed Lake	Point Thomson Unit development area (Sec. 22 & 23, south of airstrip)			923,000	No	Used for Yukon Gold and Sourdough ice roads

7.3.4 *Tankage*

Table 7-5 illustrates the tanks and storage areas required for the project. Because the information provided in this table may change as engineering design develops, results of ongoing studies will be used to better define the actual tank sizes, contents, and locations. If required, tanks and associated instrumentation will be heat-traced and insulated to avoid damage during freezing weather.

Diesel fuel is required at the beginning of the project to support initial drilling activities and construct infrastructure, and to supply the diesel-powered generators. Later, when the permanent gas-fired power plant is in operation, the diesel tanks will be used to store fuel to supply vehicles and support the emergency generators. Four 12,500-bbl tanks will be installed to meet these purposes. This capacity provides sufficient fuel, with re-supply by either tanker trucks or barge, to support the various phases of the project through the first two years of construction and operations. The diesel tanks will be designed to applicable American Petroleum Institute (API) standards and will be located in a lined containment area. The tanks, which may double-walled, will have a leak detection system, and an instrumentation and controls system adequate to safeguard the tank storage, loading, and dispensing operations.

Methanol is required for hydrate and freeze protection during start-up and shut-down of the wells, the production and injection pad piping, the gathering lines from the East and West Well Pads, and the injection lines from the CPF Pad to the CWP (Table 7-5).

Provision will also be made for the storage of several other chemicals including drag reducing agent, corrosion inhibitor, various drum chemicals, etc. as required to support ongoing operations. These tanks will be defined throughout the engineering design process.

7.3.5 *Telecommunications*

A communication tower and associated equipment will be installed on the Point Thomson CPF Pad. The existing communication system at Badami will act as a repeater system enabling the exchange of voice and data signals between Point Thomson and Prudhoe Bay, existing systems on the North Slope (e.g., Alaska Clean Seas), and the outside world. Power and communications cables will be buried in the gravel roads to the airstrip and to the outlying production well pads for operation and control of the airstrip and the production well pad facilities and gathering pipelines.

The private microwave connection will carry voice and data signals into the facility. The tower is presently planned to be approximately 300 ft (91 m) tall, and will be the facility's tallest structure. A separate communication building will, for reasons of radio frequency (RF) efficiency, house all RF equipment. This building will be located near the foot of the main microwave tower.

A buried fiber-optic cable will carry multiple channels of voice, data, distributed control system signals, and basic process control system signals to/from the West, East, and Central Well Pads, and the CPF Pad. Ultra high frequency radio will link the SCADA system to the pipeline remote terminal units. Plant radio systems will provide a voice communication system in the plant and pad areas. Spill response radios will provide additional secure communication along and adjacent to the pipeline.

TABLE 7-5
PROPOSED TANKS AND STORAGE AREAS

LOCATION	DESCRIPTION	APPROXIMATE SIZE	NOTES
CPF PAD	Potable Water Tank	1,000 bbl	Located inside the utility module building or at camp
	Fire Fighting-Potable Water Tank	12,500 bbl	Located outdoors or at utility module
	Cold Storage Area (chemical, lube oil, etc., drums and containers)	50 ft by 150 ft (15 m by 46 m) This is approximate size and may be adjusted once quantities better defined.	Located outdoors, lined with high-density polyethylene attached to a 1-ft (30-cm) high-retention curb
	Diesel Fuel Tank	4 tanks 12,500 bbl each (One tank may be converted to produced water and the other to condensate storage)	Located outdoors within a diked area; may be double-walled
	Drag Reducing Agent Tank	500-800 bbl	Located outdoors, insulated and heated (may be a tanker)
	Methanol Tank	2 tanks 1,500 bbl each	Located outdoors
	Produced Water Tank	2,000 bbl	Located outdoors; may be double-walled
	Raw Water Tank	1,000 bbl	Outdoor or utility mod.
	Other Production Chemicals (corrosion inhibitor, emulsion breaker, etc.)	Various	In totes or small tanks as locations where required (CPF, CWP, East and West Well Pads)
	G&I System Storage Pit (Likely to change)	15,000 bbl (115 ft by 265 ft [35 m by 81 m])	Open lined pit/diked area
EAST & WEST WELL PADS	Methanol Tank	2,000 bbl	Located outdoors, each pad
	Diesel Tank	2,000 bbl	Located outdoors, each pad

Navigation and communication equipment will be located at the Point Thomson airstrip. This equipment will include:

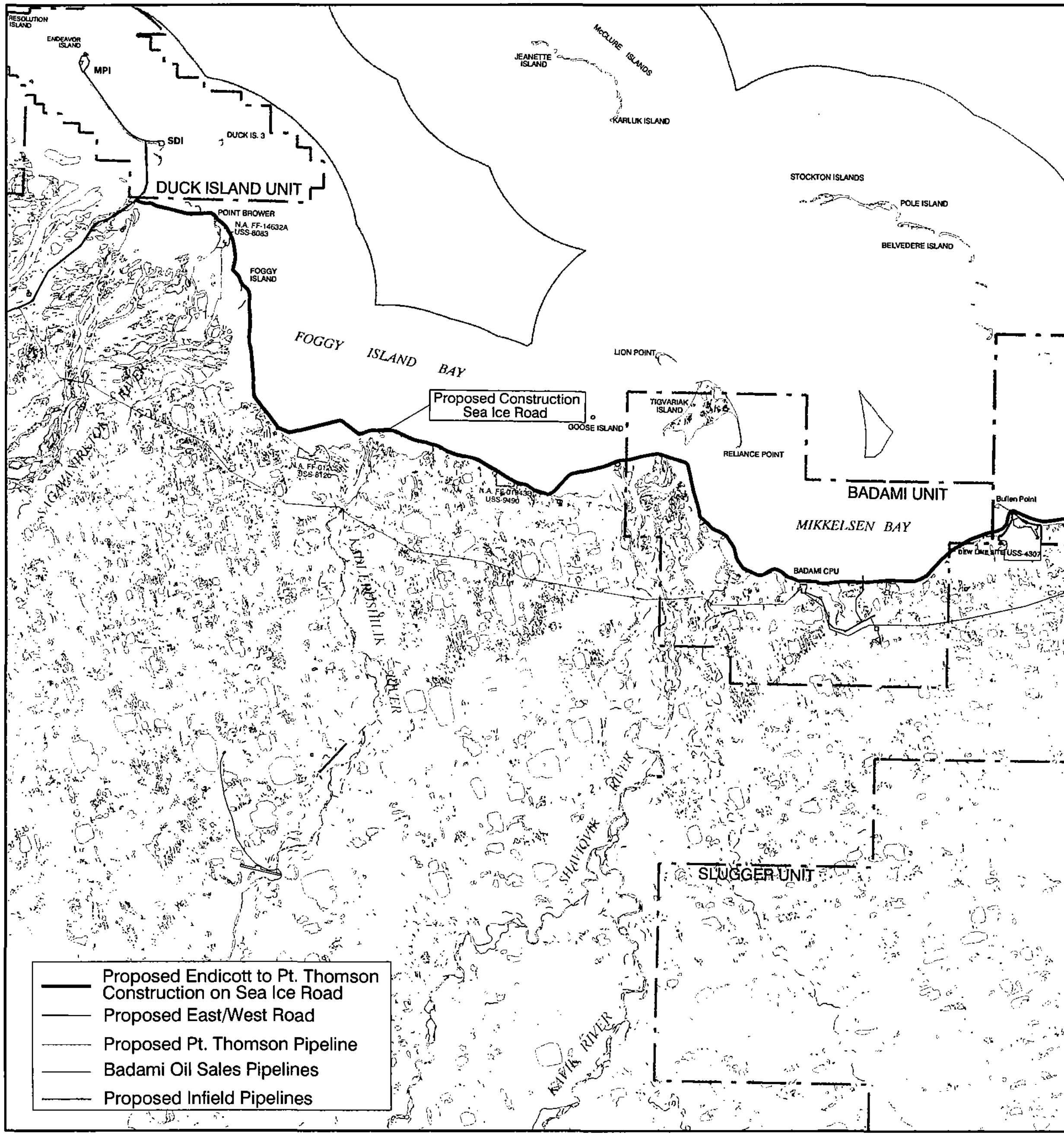
- Non-directional beacon,
- Distance measuring equipment,
- Pulsed light approach slope indicator,
- Meteorological automatic radio,
- Universal communication,
- Runway lighting, and
- Global positioning system approach.

7.3.6 Electrical Power Facilities

Early power generation equipment will be installed to supply power for the drilling and construction infrastructure and life support, at a minimum. Initially the diesel power emergency generators will provide power. When gas and the fuel gas-fired turbines are available, these will be the primary power source. Early power generation and distribution equipment will be the same size and type as will be required for the permanent facility. Additional backup power generators will be provided with the rig and camps and by the construction contractor.

The power requirements identified in the Conceptual Engineering work for the Point Thomson Gas Cycling Project are estimated to be over 10 megawatts. The long-term power generation system will be configured with fuel-gas (produced natural gas back-flowed from an early injection well) turbine generators each sized to handle the permanent power load. The emergency diesel generators will be available and able to provide for emergency and life support power requirements. Options are being considered to have the rig supplied with electrical generators (diesel and/or gas) in order to reduce the size of the central power facility.

Power feeds to the East and West Well Pads will be stepped up through transformer located at the generation module (where all power generation equipment will be connected) and reduced to operating voltages via transformers located at the well pads. Where practical, the power cables feeding the well pads will be incorporated into the permanent facilities design. Some of the early power may be provided through local above-ground lines, but the permanent power cables will be buried in the gravel roads.



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POINT THOMSON GAS CYCLING PROJECT
SEA ICE ROAD

DATE:	SCALE:	FIGURE:
September 2002	1" = 4 Miles	7 - 1

fig7_1.dgn

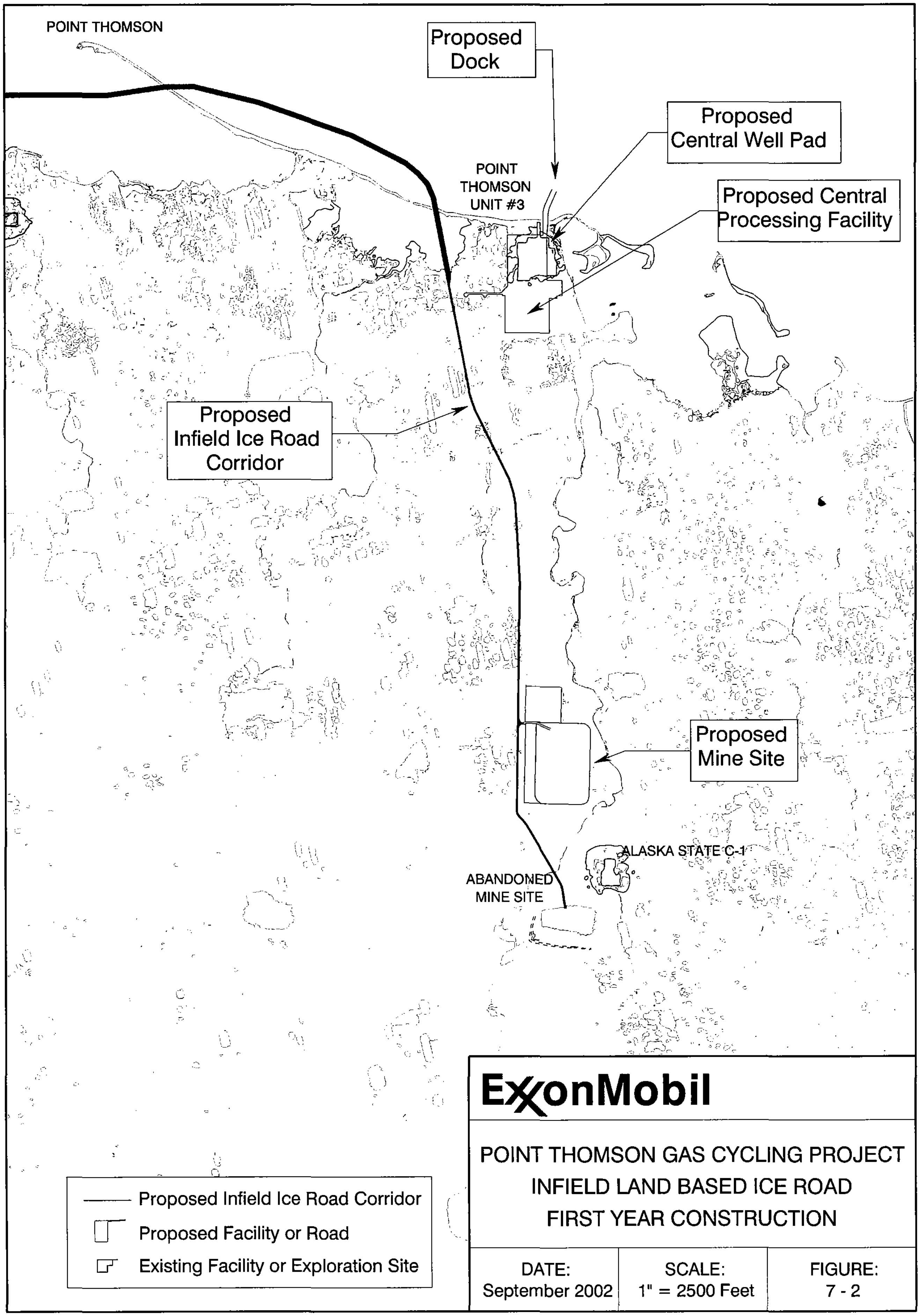
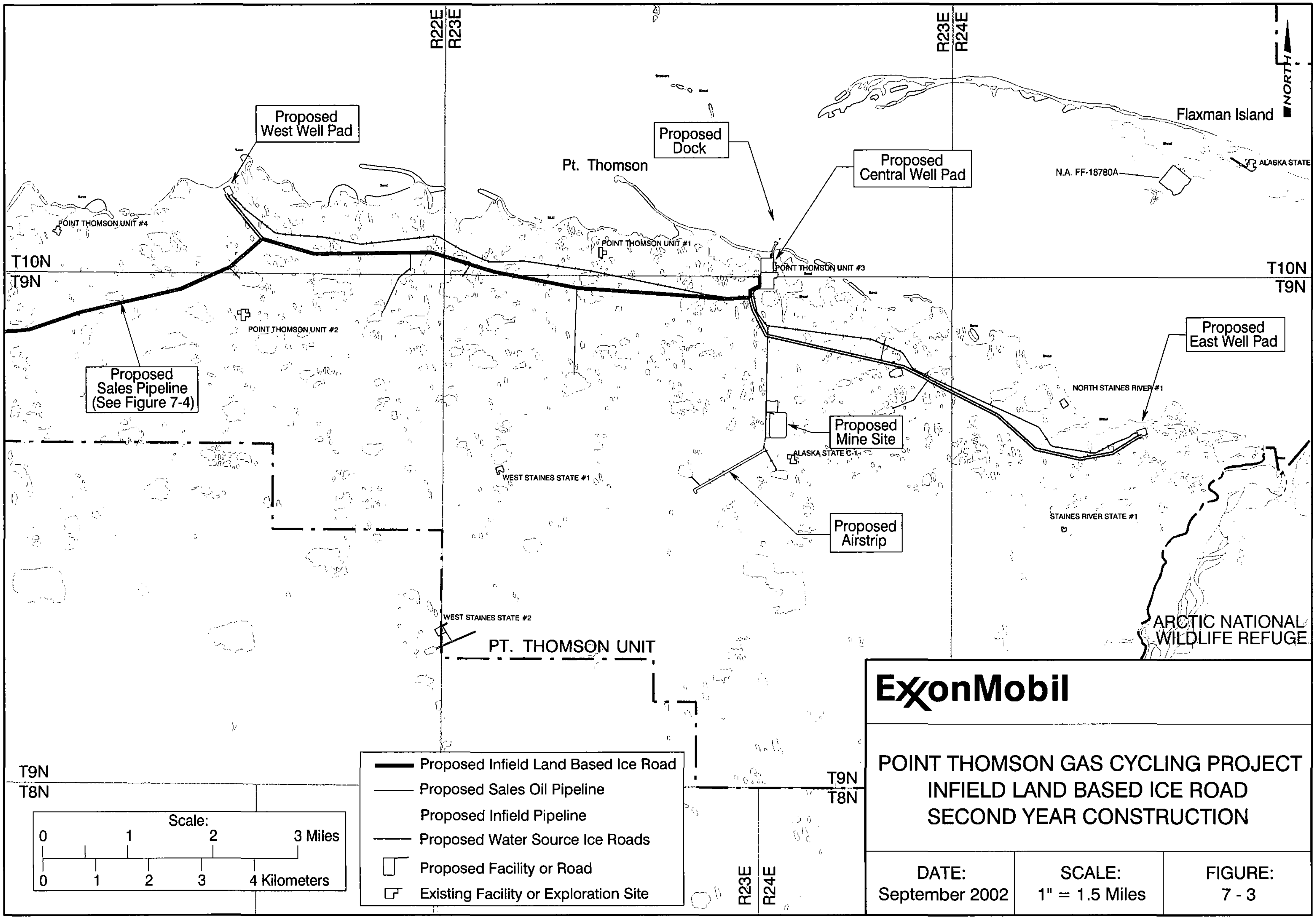

POINT THOMSON
Proposed Dock
Proposed Central Well Pad
Proposed Central Processing Facility
POINT THOMSON UNIT #3
Proposed Infield Ice Road Corridor
Proposed Mine Site
ALASKA STATE C-1
ABANDONED MINE SITE
Proposed Infield Ice Road Corridor
Proposed Facility or Road
Existing Facility or Exploration Site
ExxonMobil
POINT THOMSON GAS CYCLING PROJECT
INFIELD LAND BASED ICE ROAD
FIRST YEAR CONSTRUCTION
DATE: September 2002
SCALE: 1" = 2500 Feet
FIGURE: 7 - 2

fig7_2.dgn



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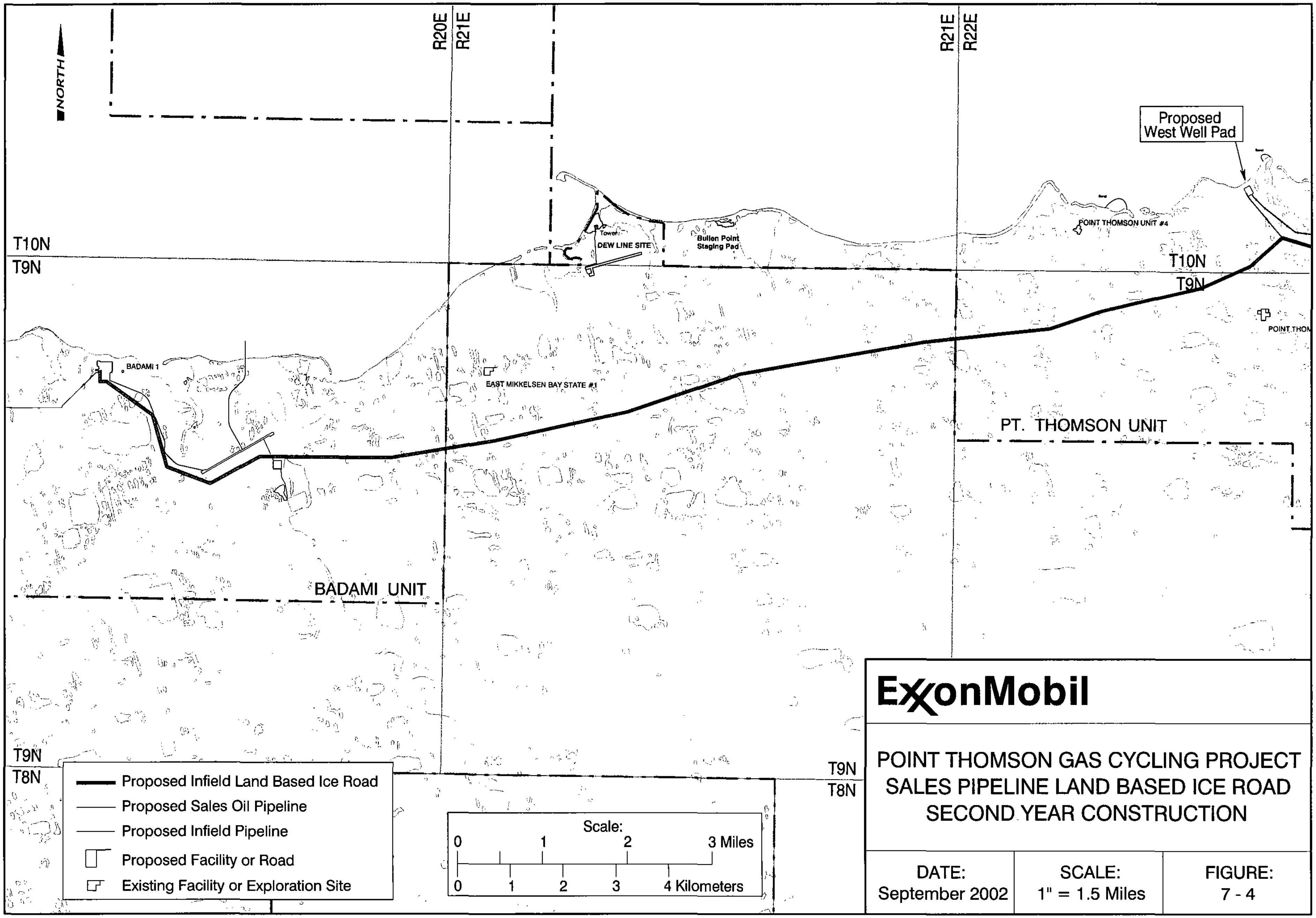
POINT THOMSON GAS CYCLING PROJECT
INFIELD LAND BASED ICE ROAD
SECOND YEAR CONSTRUCTION

DATE:	SCALE:	FIGURE:
September 2002	1" = 1.5 Miles	7 - 3

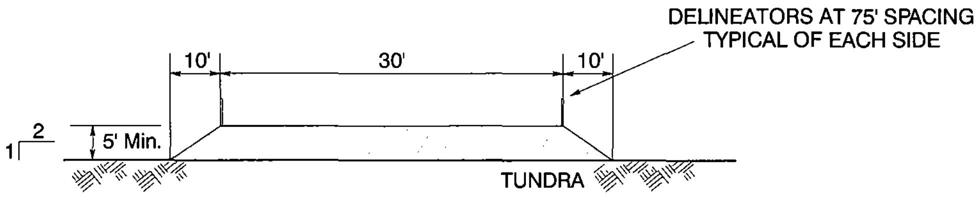
fig7_3.dgn



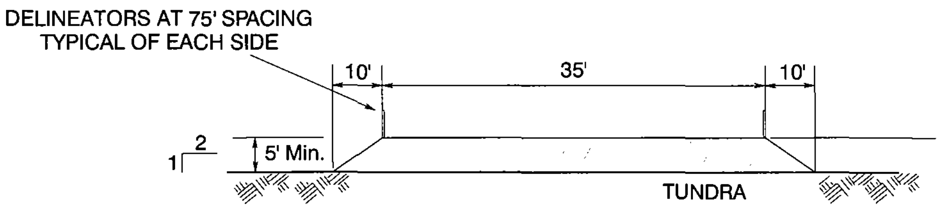
POINT THOMSON GAS CYCLING PROJECT
SALES PIPELINE LAND BASED ICE ROAD
SECOND YEAR CONSTRUCTION

DATE:	SCALE:	FIGURE:
September 2002	1" = 1.5 Miles	7 - 4

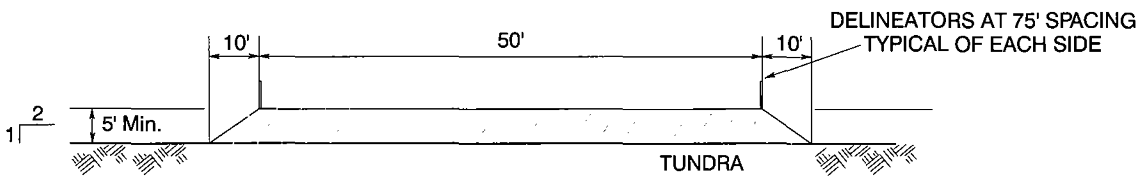
fig7_4.dgn



TYPICAL 30' ROAD SECTION



TYPICAL 35' ROAD SECTION



TYPICAL 50' ROAD SECTION

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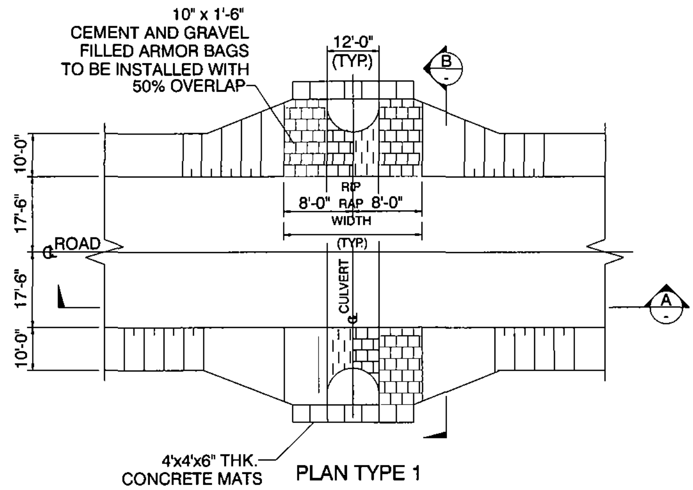
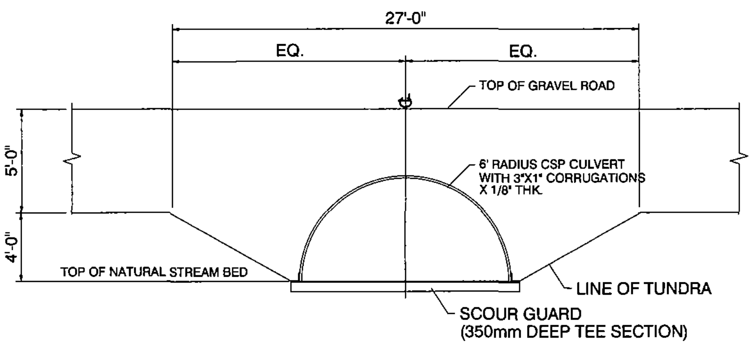
POINT THOMSON GAS CYCLING PROJECT
TYPICAL 30-FT, 35-FT, AND 50-FT
ROAD CROSS SECTIONS

DATE:	SCALE:	FIGURE:
September 2002	Not to Scale	7 - 5

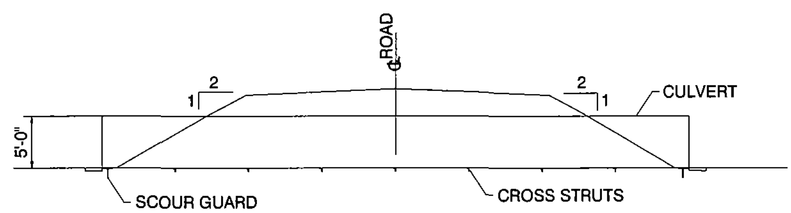
ex14464cross.dgn



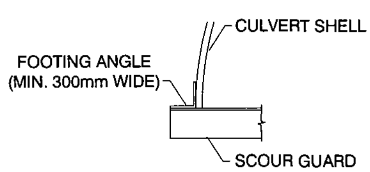
PLAN TYPE 1



SECTION A



SECTION B



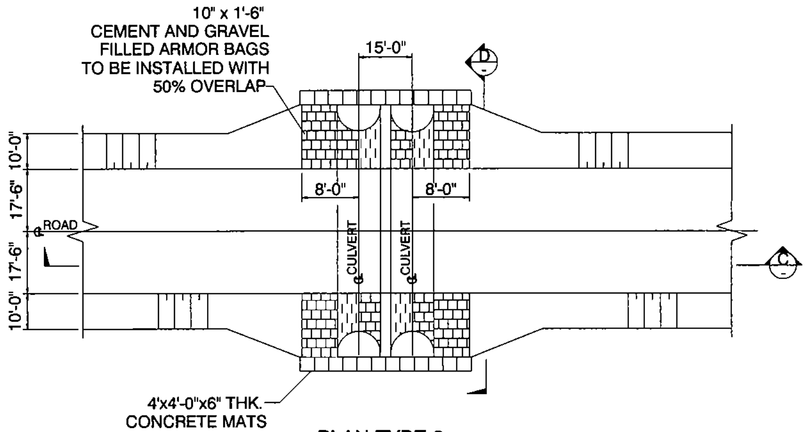
DETAIL 1

ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
SINGLE CULVERT

DATE:	SCALE:	FIGURE:
September 2002	Not To Scale	7 - 6

ex14464cross.dgn



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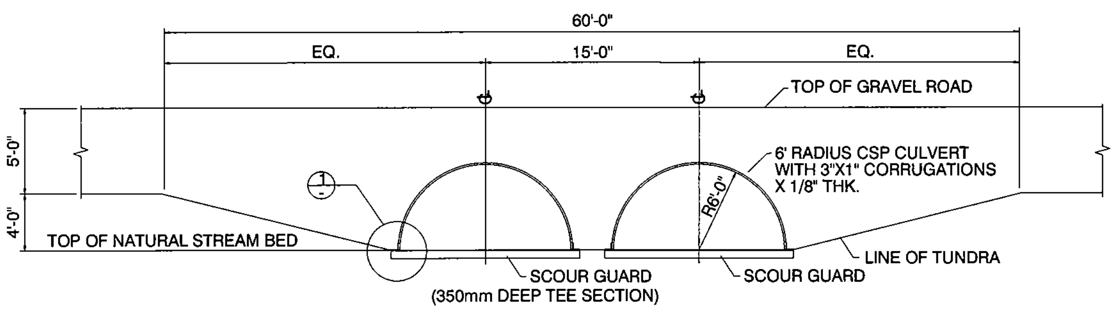
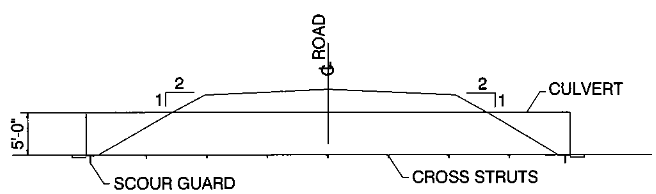


SECTION C



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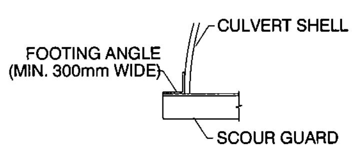


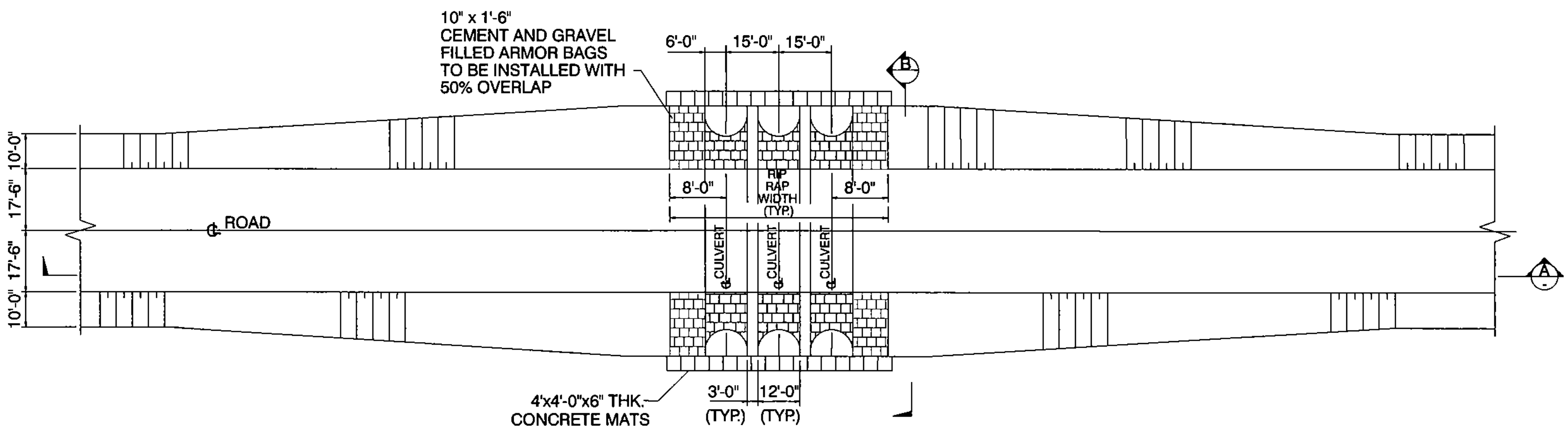
DETAIL 1

ExxonMobil

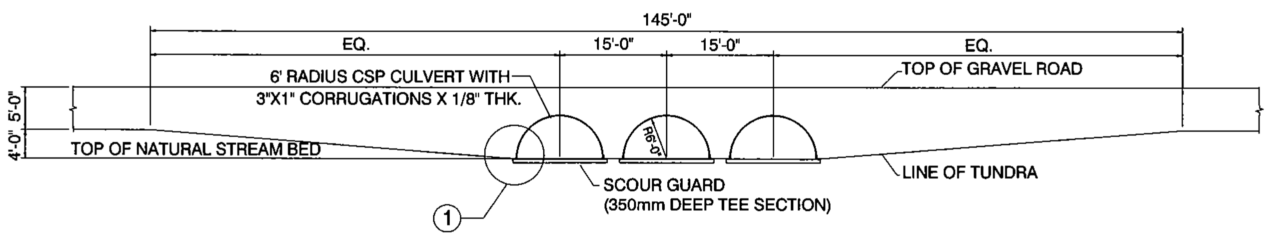
POINT THOMSON GAS CYCLING PROJECT
DOUBLE CULVERTS

DATE:	SCALE:	FIGURE:
September 2002	Not To Scale	7 - 7

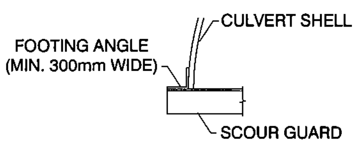
ex14464cross.dgn



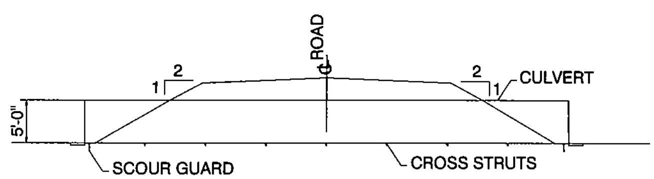
PLAN TYPE-3



SECTION A



DETAIL 1



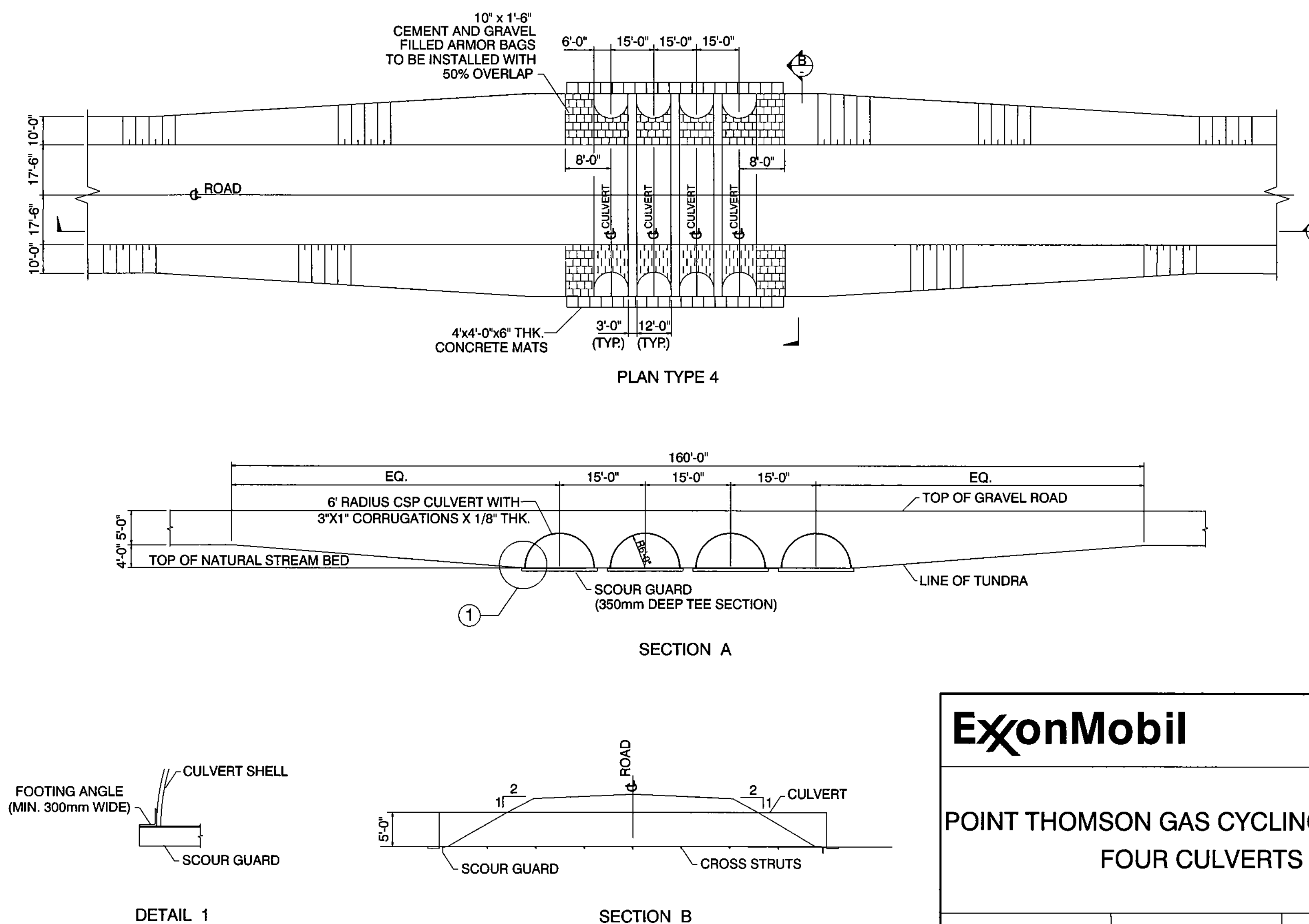
SECTION B

ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
TRIPLE CULVERTS

DATE:	SCALE:	FIGURE:
September 2002	Not To scale	7 - 8

ex14464cross.dgn

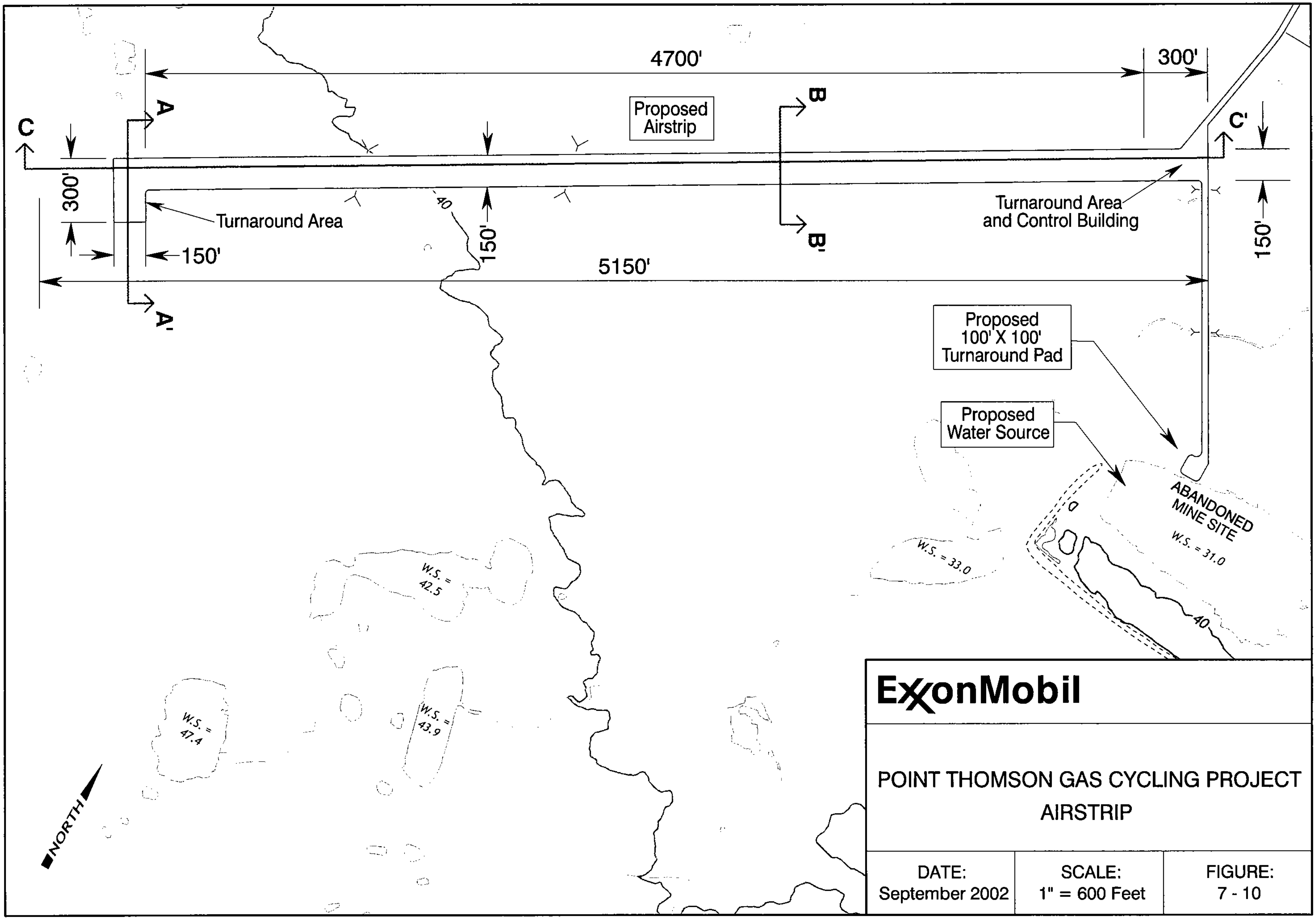


ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
FOUR CULVERTS

DATE:	SCALE:	FIGURE:
September 2002	Not To scale	7 - 9

ex14464cross.dgn

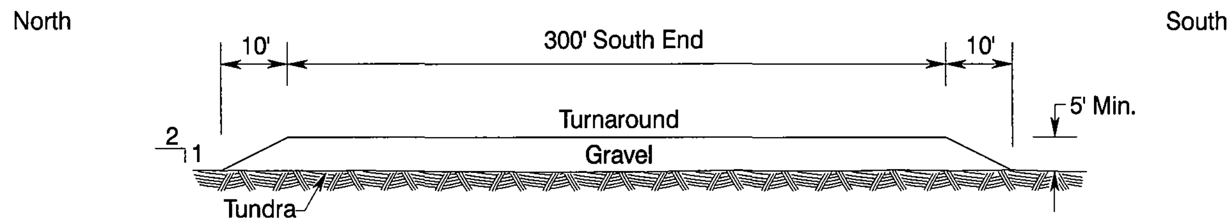


ExxonMobil

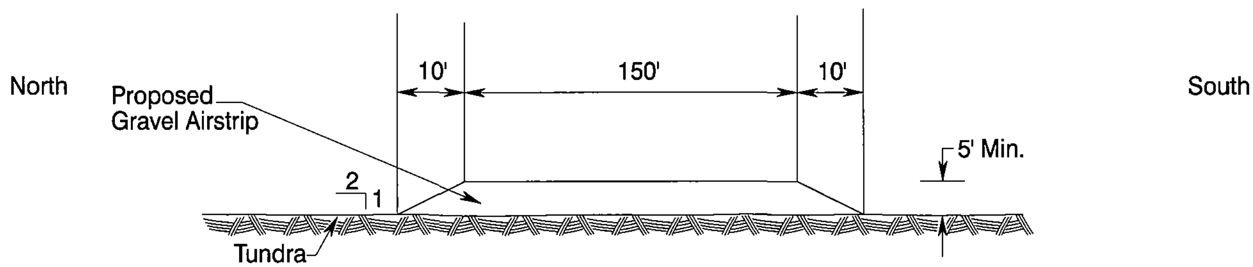
POINT THOMSON GAS CYCLING PROJECT
AIRSTRIP

DATE:	SCALE:	FIGURE:
September 2002	1" = 600 Feet	7 - 10

ex14464plan.dgn



Section A - A'



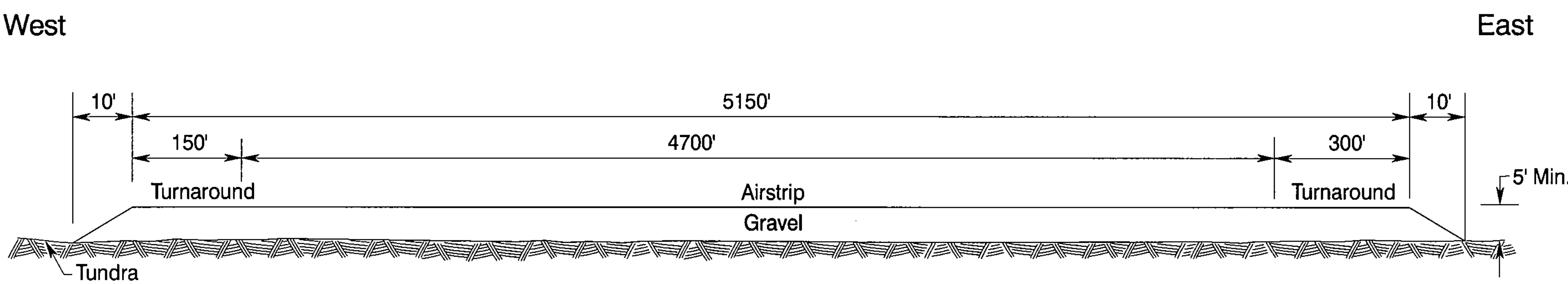
Section B - B'

ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
AIRSTRIP CROSS - SECTIONS
(A - A' AND B - B')

DATE:	SCALE:	FIGURE:
September 2002	Not to Scale	7 - 11

ex14464cross.dgn



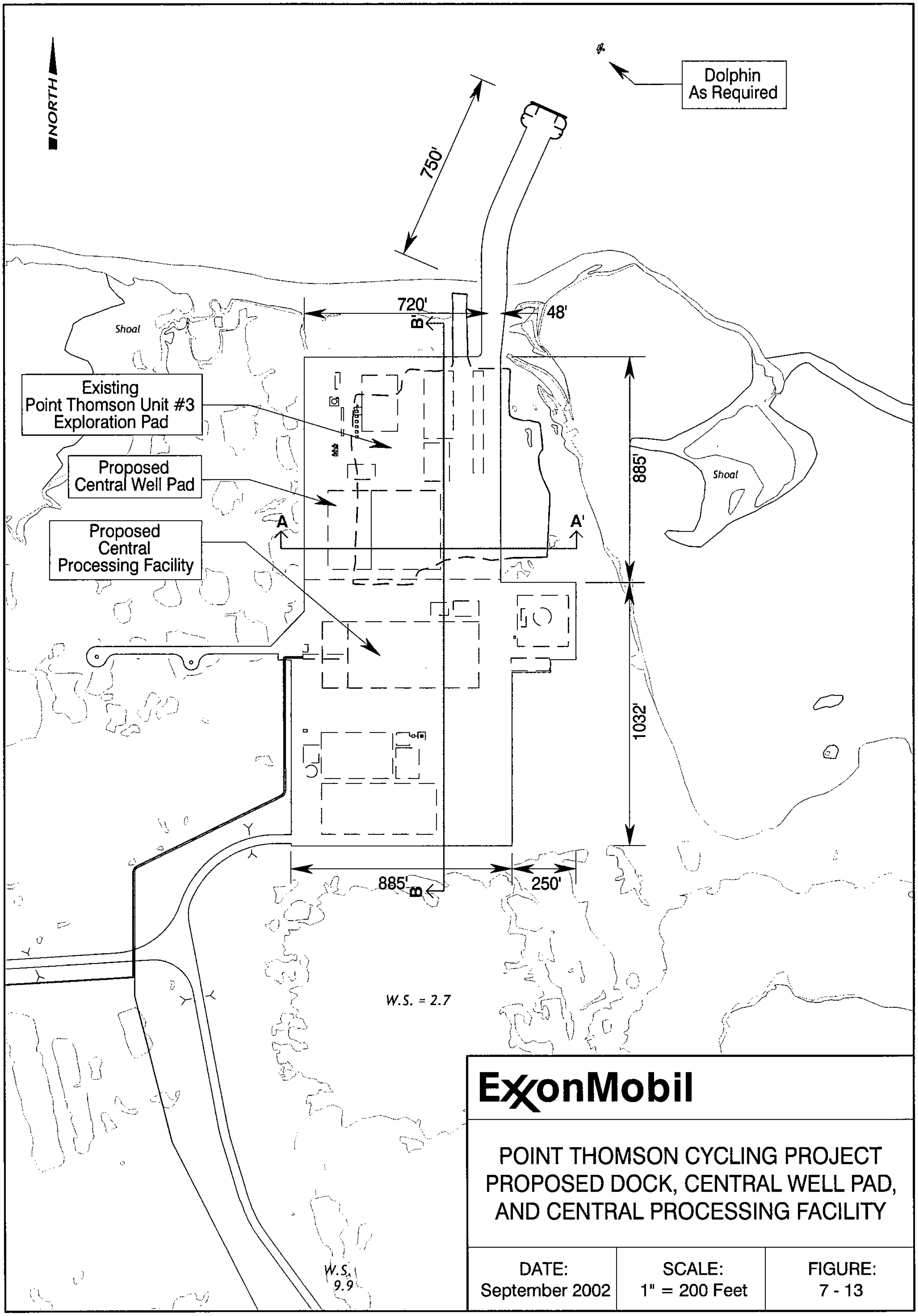
Section C - C'

ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
PROPOSED AIRSTRIP
CROSS - SECTION (C - C')

DATE:	SCALE:	FIGURE:
September 2002	Not to Scale	7 - 12

Ex14464cross.dgn

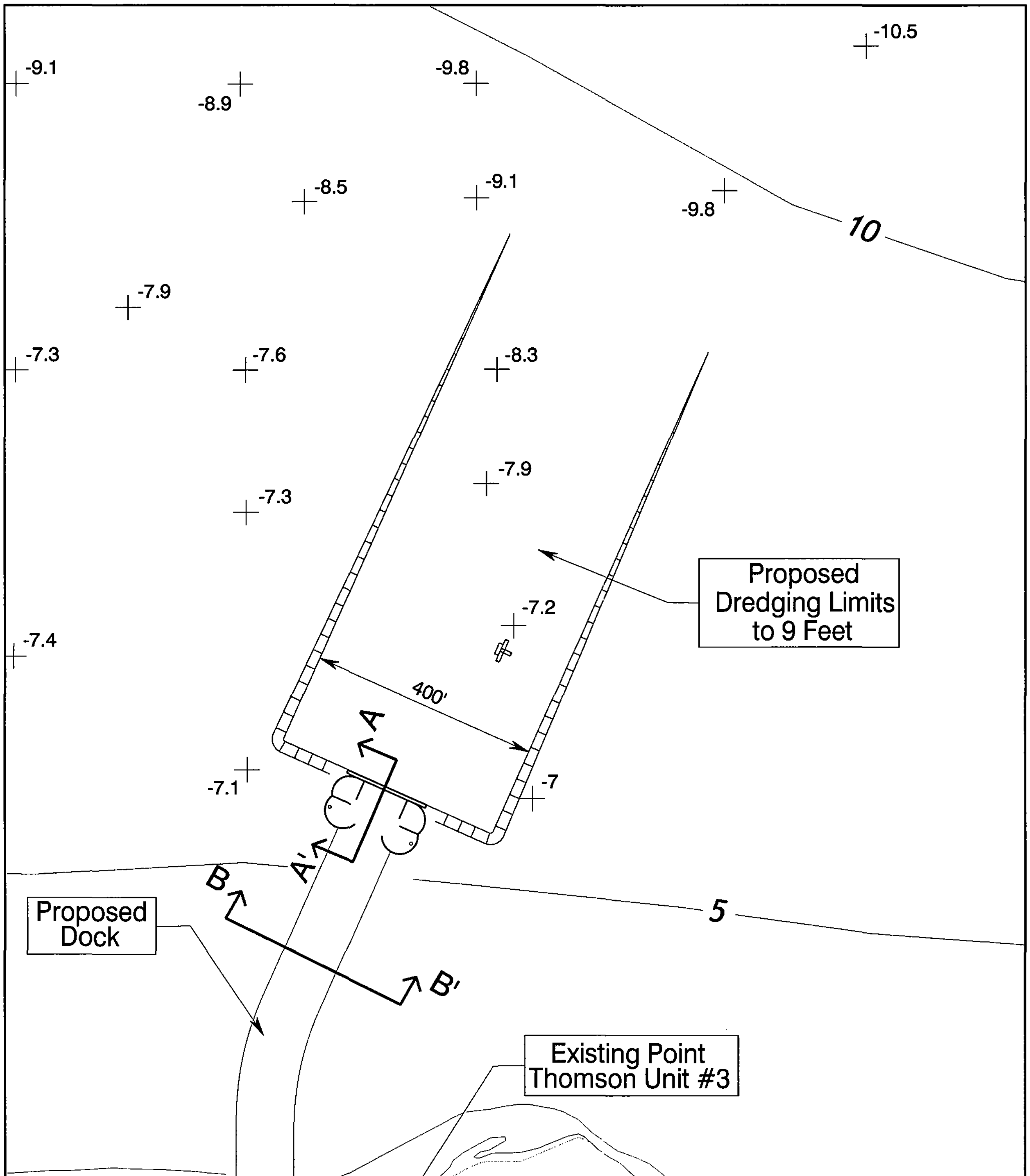


ExxonMobil

POINT THOMSON CYCLING PROJECT
PROPOSED DOCK, CENTRAL WELL PAD,
AND CENTRAL PROCESSING FACILITY

DATE:	SCALE:	FIGURE:
September 2002	1" = 200 Feet	7 - 13

ex14464plan.dgn



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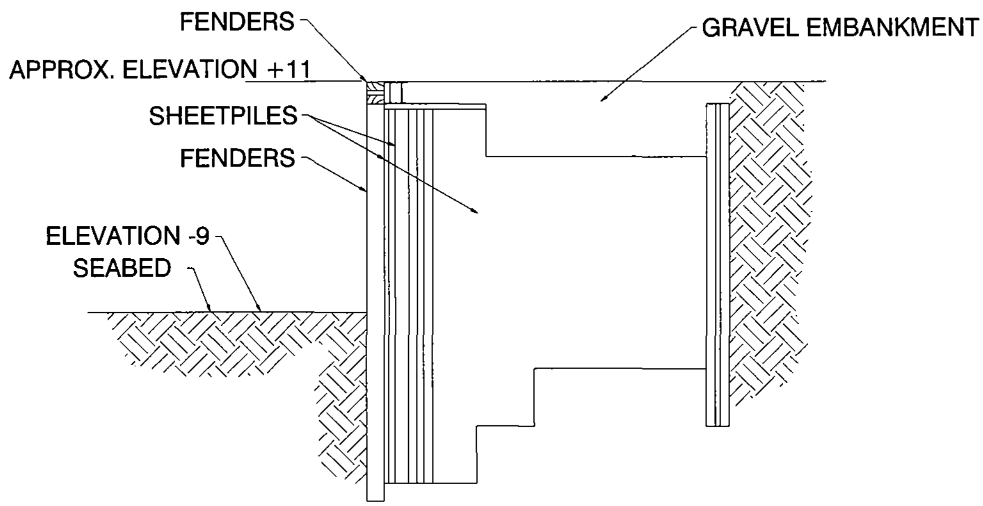
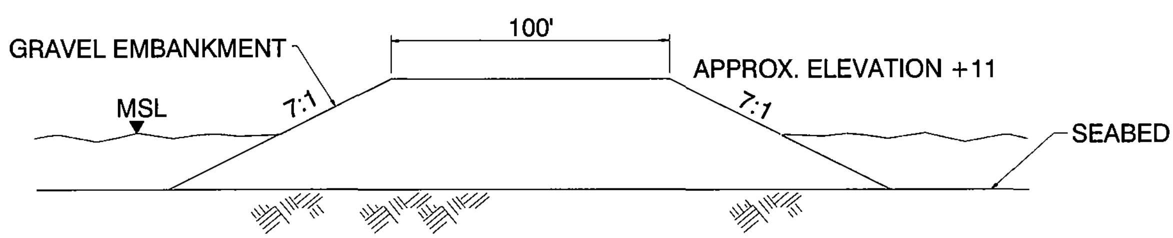
POINT THOMSON GAS CYCLING PROJECT
PROPOSED DOCK AND CHANNEL

DATE:	SCALE:	FIGURE:
September 2002	1" = 250 Feet	7 - 14

Fig7_14.dgn



SECTION A - A'



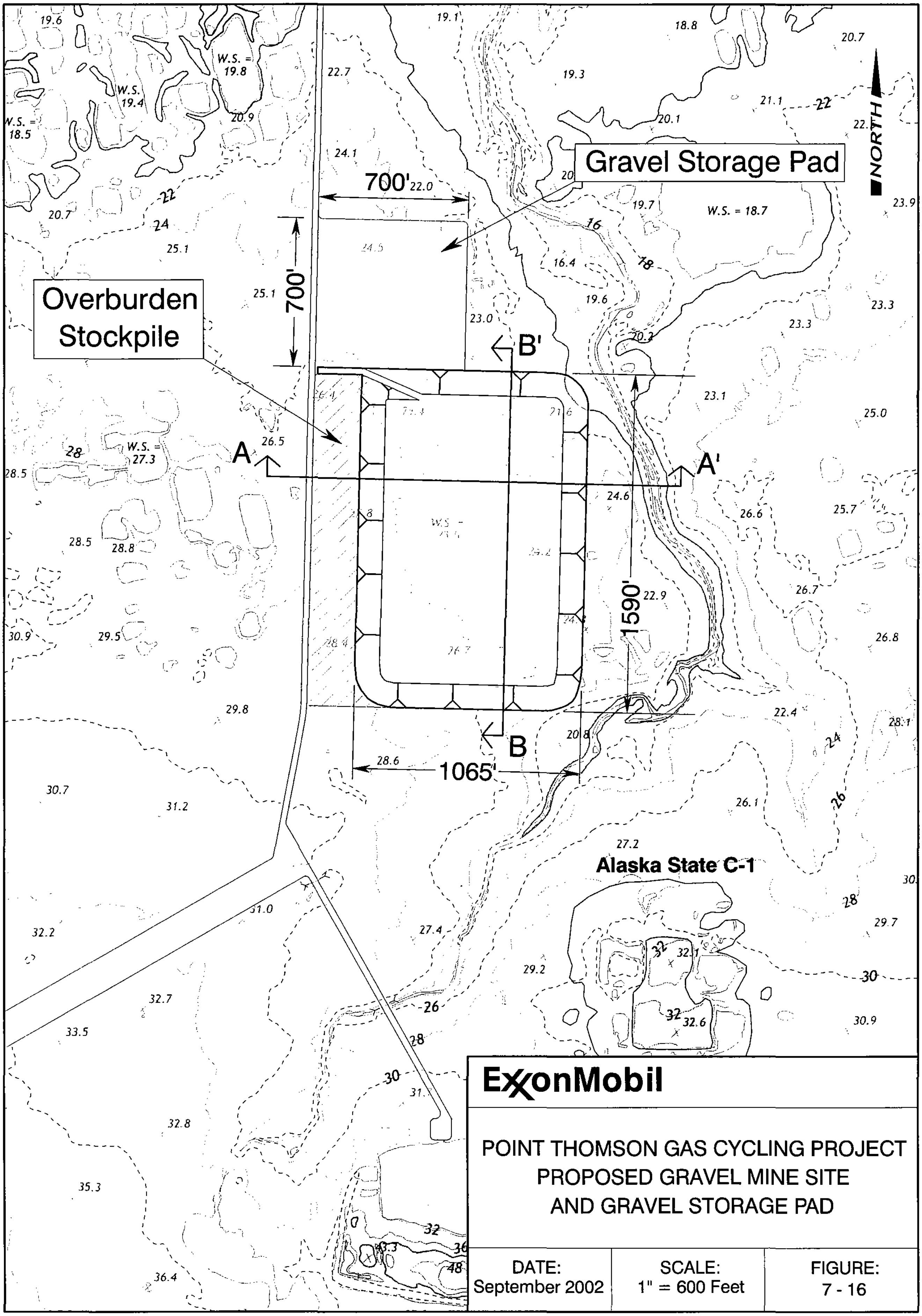
SECTION B - B'

ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
DOCK CROSS-SECTION

DATE:	SCALE:	FIGURE:
September 2002	Not To Scale	7 - 15

ex14464cross.dgn

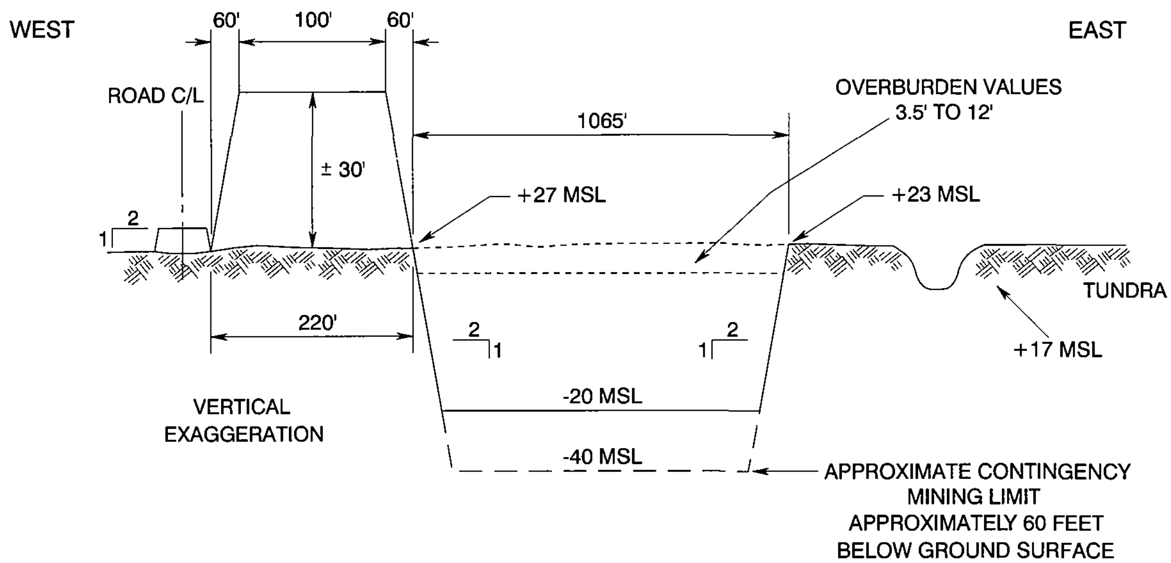


ExxonMobil

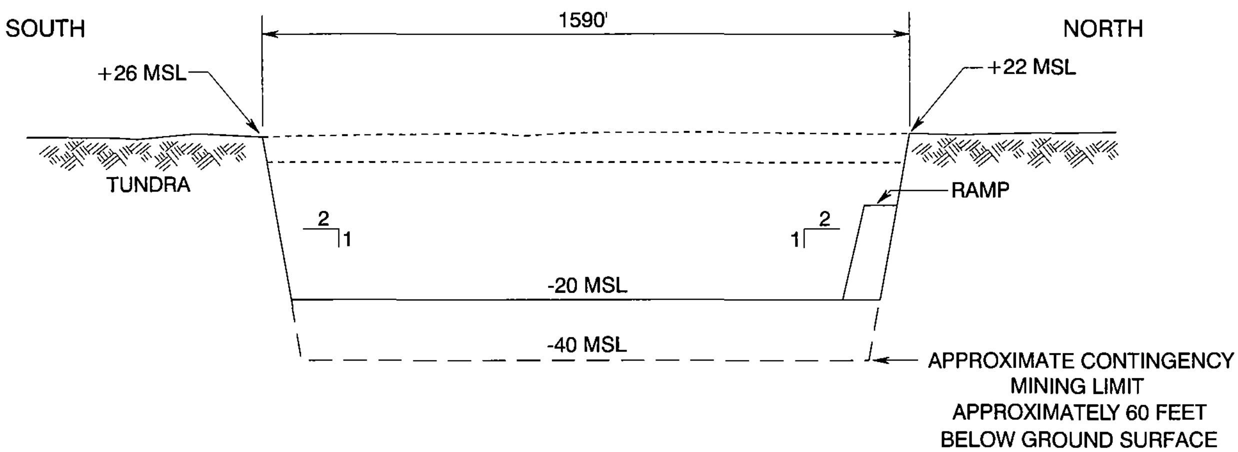
POINT THOMSON GAS CYCLING PROJECT
PROPOSED GRAVEL MINE SITE
AND GRAVEL STORAGE PAD

DATE:	SCALE:	FIGURE:
September 2002	1" = 600 Feet	7 - 16

fig7_16.dgn



SECTION A - A'



SECTION B - B'

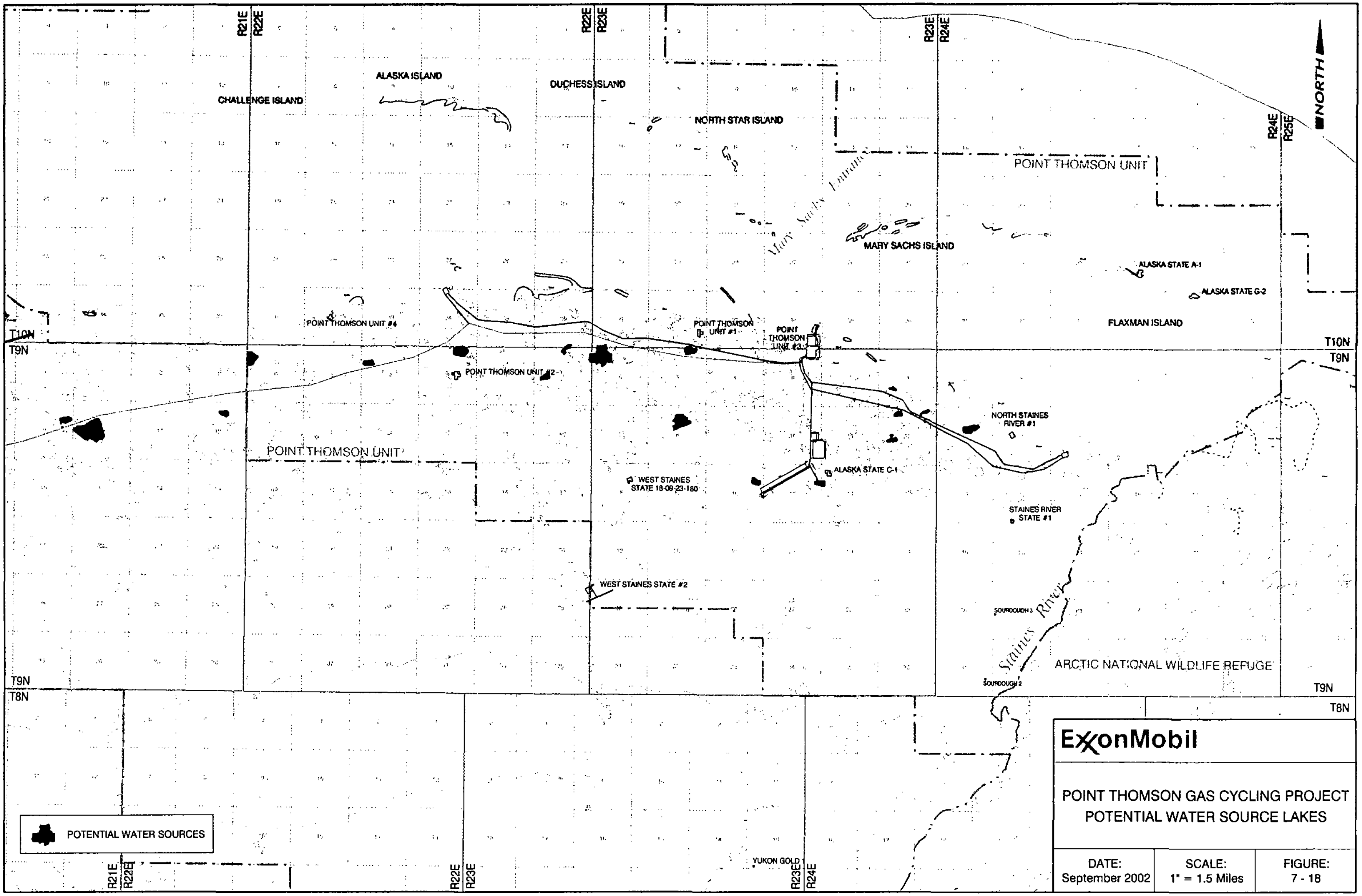
ALL DEPTHS NOTED IN FEET

ExxonMobil

POINT THOMSON GAS CYCLING PROJECT
PROPOSED MINE SITE
CROSS SECTIONS

DATE:	SCALE:	FIGURE:
September 2002		7 - 17

fig7_17.dgn



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POINT THOMSON GAS CYCLING PROJECT
POTENTIAL WATER SOURCE LAKES

DATE:	SCALE:	FIGURE:
September 2002	1" = 1.5 Miles	7 - 18

fig7_18.dgn

8.0 OPERATIONS AND MAINTENANCE

8.1 INTRODUCTION

Operations and maintenance of the Point Thomson facilities will be governed by the operational requirements for the project. These specifications will incorporate a central control room (CCR) for functional control of plant processes, monitoring security, safety surveillance of emergency shutdown systems, a fire and gas monitoring system, remote activation of pig launching operations, and data gathering as may be required by a surveillance system. In addition, Production Operations Best Practices (POBP) will be used for any issues/concerns not covered by the specifications.

The following sections provide descriptions of the operational requirements, including maintenance issues, for the civil works, pipelines, and process facilities. A section is also included on anticipated air emissions.

8.2 CIVIL WORKS MAINTENANCE

8.2.1 Roads, Pads, and Airstrip

To ensure the integrity of the airstrip, pads, and roads, routine inspection will be required to ensure the integrity of the airstrip, pads, and roads. The operations at Point Thomson will maintain and use road maintenance equipment such as motor graders, front-end loaders, backhoes, and water tankers for dust control. Maintenance will be performed on an as-needed basis. Care will be taken not to damage the permafrost or the tundra.

8.2.2 Drainage Structures

Drainage systems will be inspected periodically as part of routine operations. Required equipment will be dispatched to remove debris, snow, etc. from culverts and storm-water collection basins.

8.2.3 Snow Removal and Storage

In accordance with all ExxonMobil SHE guidelines, the Point Thomson facilities will be well-kept and maintained. During the winter months, snow removal activities will be conducted on an ongoing basis. Personnel and equipment such as front-end loaders and motor graders will be available to handle the snow removal requirements at the Point Thomson CPF, well pads, and airstrip.

To ensure a safe operating facility, a Standard Operating Procedures (SOP) Manual will be developed before operations start-up. The SOP Manual will include a section detailing snow removal and handling procedures. These procedures will also address handling and disposing of contaminated snow, which will be visually inspected for contamination before removal. Contaminated snow will be collected and stored in a specially designated area for proper disposal (the location of the storage area will be determined at a later date). Snow may be allowed to melt, or a snowmelter will be used; the contaminated meltwater will be injected into the disposal well. Uncontaminated snow will be pushed onto surrounding tundra and/or dumped onto the lagoon sea ice, where it will be allowed to melt into the ocean during breakup.

Further definition of pad designs will be made during Preliminary Engineering and will include considerations of snow storage options. While large accumulations of snow are possible during some winters, potential effects of snow storage are anticipated to be minimal. Snow dumps not only can be located on unused portions of pads but also could be located off-pad for uncontaminated snow.

8.3 PIPELINE MAINTENANCE

8.3.1 Infield Gathering and Injection Lines

Visual inspections of the gathering and injection lines will be conducted as part of the routine operations.

8.3.2 Export Pipeline

The export pipeline will not require major effort to ensure trouble-free function. Visual external inspection of the export pipeline will occur from existing roads, or by air where road access is not possible. Internally the pipeline will be periodically inspected using "smart" pigs. The facilities containing the isolation valves, pig launchers/receivers, and associated instrumentation and controls may be contained in enclosures.

Repairs to the pipelines and facilities can be completed from roads running along the alignment of the pipelines (where roads are available), by using Rolligons when tundra travel is allowed, or from ice roads built during winter to access a specific location. Access can also be achieved by employing a helicopter to move personnel and equipment directly to a specific location for minor repair and maintenance. Typically, minor repairs will require only hand tools and, possibly, welding equipment. Major repairs might require the use of earth-moving equipment, cranes and lifting equipment, and specialized tools and materials. Minor and major pipeline repairs will be scheduled, where possible, to ensure equipment, materials, and personnel required to conduct these repairs will be available.

In order to provide quick response to minor emergencies and to perform repairs to the facilities dedicated to the pipeline flow and leak detection, spare parts and replacement materials will be maintained at the Point Thomson warehouse. Personnel at Point Thomson will supervise all pipeline repairs.

8.4 PROCESS FACILITIES

8.4.1 Gas Injection

The injection compressors will be in a fully enclosed modular building. There will be a long-term service agreement with a contractor to provide scheduled maintenance for the facility. Regular inspections by Operations personnel of the entire injection system will be performed to minimize downtime. Critical spare parts for the injection system will be warehoused at Point Thomson. An independent console will be located in the CCR along with a local equipment room to display functionality and status of the entire system. An anti-surge system will be installed on the compressors to ensure the load is balanced among the compressors.

The gas injection system will be connected with the entire emergency shutdown system of the CPF. The gas injection wells will be located within the CWP and access to them will be limited to authorized plant personnel only.

8.4.2 Produced Water

Produced water from the low-pressure (LP) compressor scrubber, third-stage separator, and the condensate dehydrator will be routed to the produced water separator. The produced water booster pump will send the water to the G&I system at the CWP for disposal in a disposal well. Condensate will be skimmed off the produced water in the separator and pumped back to the condensate dehydrator by the produced-water skim-oil pumps.

8.4.3 Exterior Lighting

Interior and exterior process areas will have high-pressure sodium lighting. Control and electrical rooms will have fluorescent lighting supplied from 120-volts alternating current uninterrupted power supply systems (UPS). Process area egress lighting to meet Uniform Building Code requirements will be powered from Underwriters Laboratories listed UPS.

8.4.4 Instrumentation and Controls

Operations at the Point Thomson Unit will be controlled from the CCR. Operating consoles located in the control room will display process conditions and equipment status, including any alarms, trip conditions, and fire/gas detection. Alarms will be relayed to the operator on a real-time basis, thus allowing the operator to make rounds through the plant while remaining in the control room.

The process control system (PCS) will be able to monitor and control the entire operation (both plant and field). The PCS will have standard local-area-network-based workstations for operator consoles; this will provide the operator and the maintenance technicians the ability to check or configure a device from any location at the facility. The PCS will continually monitor devices and deliver real-time data on their operation. The system provides the following capabilities:

- The ability to pinpoint poor equipment performance;
- Optimization of maintenance activities;

- Early detection of failures of key pieces of equipment, reducing lost production and repair costs; and
- Identification of faulty instruments and subsequent prevention of incorrect and potentially costly actions based on bad data.

Alarms will be annunciated at the human/machine interface (HMI) in the CCR by way of visual images on the associated graphics and by an audible signal. Alarms that are acknowledged at the HMI and CCR will automatically be acknowledged at all other HMIs in the CCR and in the local equipment room buildings. High priority alarms, such as confirmed fire and gas events or potential leaks, will additionally be annunciated on a dedicated hard-wired alarm panel.

The facilities' public address and general alarm system will receive signals from the safety systems, manual call stations, and PCS, and will provide unique audible alarms (tones with voice overlay messages) to the audible stations.

- In addition to control and monitoring from the CCR, certain major pieces of equipment will have their own stand-alone local control and monitoring panels. These panels will provide local control during normal operation, and will assist Operations during equipment start-up and system trouble-shooting.

8.4.5 Flare

The bulk of the flammable material in the Point Thomson gathering system, plant, and gas injection system will be natural gas. The flare system will be used to safely burn gases which may occasionally need to be released when pipelines and facilities are depressurized for maintenance or when there is a temporary facilities upset. Depressurization and flaring might also be necessary if there is an emergency in the facility. Vented gas will first flow to flare knock-out drums, where liquids will be separated before the gas is sent to the flare. There are two separate flare systems, one for high-pressure gases and one for low-pressure gases. Emissions from the flare events are expected to consist mostly of methane, with small amounts of propane and CO_2. Noise associated with high flare-rate excursions is expected to be similar to that generated at other North Slope operations.

Since gas flaring will be limited to serious plant emergencies and when necessitated by maintenance, two flare scenarios are assumed: maximum and typical. The maximum gas flow rate to the flare system is more than 1.5 billion ft^3 per day (42.5 million m^3 per day). This scenario represents an abnormal emergency situation where gas is being vented at high rates from the gathering and injection pipelines and/or the plant vessels and piping. These are likely to be very rare events. The typical flare scenario represents minimal flaring at times when a single compression train is removed from service for routine or unplanned maintenance. These events could occur several times a year, and are likely to decrease in frequency as problems with new equipment are resolved. The predicted LP flare gas rate is more than 68 million ft^3 per day (1.9 million m^3 per day) based on work done to date. This rate will likely change as the engineering design matures.

Only flare pilot and purge volumes will be burned during normal (non-flaring) conditions. There will be little audible noise from this normal state. Air emissions from the pilot and purge will be included in the emission inventory for the CPF.

High- and low-pressure system flare stacks will be located just to the west of the CPF Pad. Each flare stack will reach to 100 ft (30.5 m) above the ground surface. Gas and air will mix at the flare tips located at the top of the stacks. The flare stack height will also aid in dispersion of the combustion products and will reduce ground-level heat radiation. To keep humans and wildlife from entering the zone of possible high heat radiation, a fence will enclose the area beneath the flare stacks.

The location of the flare stacks was selected to meet a number of criteria. First, the stacks need to be located as close to the plant site as practical to minimize the length and resulting pressure drop of the flare lines. Secondly, the flares must be located such that the heat radiation at any occupied area of the plant, roads, or pipeline right-of-way is maintained below a limit of 500 British thermal units (Btu) per hour per square ft. The flares will be also located downwind of the plant (based on the prevailing wind direction). Finally, the stacks will be situated so that the microwave path between Point Thomson and Badami is not obstructed during flaring.

8.5 AIR EMISSIONS

Point Thomson Gas Cycling Project activities have the potential to produce the following regulated air pollutants: nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter, and volatile organic compounds (VOCs). The type and amounts of air pollutants expected from this project will differ under construction and operations phases and will be quantified as part of the air permitting process.

Sources of emissions possible during the drilling and operations phases include:

- Emergency diesel generators located on the CPF to provide power for drilling initial wells (will switch to power from gas turbines located on the CPF once fuel gas is available);
- Drilling rig support equipment such as generators, boilers, and heaters;
- Gas-turbine-driven compressors, gas-turbine driven generators, and process heaters used for condensate separation/production and gas re-injection;
- Venting and flaring (intermittent source, with the exception of the pilot and purge volumes); and
- Vehicles, marine vessels (in summer), helicopters, and airplanes used to transport equipment, materials, and personnel to and from the site.

The main sources of emissions during drilling and operations will likely be the gas turbines for power generation and gas compression. The emissions from these turbines will consist mainly of NO_x and CO, with lesser amounts of SO_2 and particulates. Diesel generators and support equipment will produce NO_x, with lesser amounts of SO_2, CO, and particulates. Flaring will burn most VOCs, but will produce some NO_x, with lesser amounts of SO_2, CO, and particulates. Vehicle, marine vessel, and airplane emissions are expected to consist mainly of CO, with small amounts of VOCs from aviation and other fuels.

9.0 LOGISTICS AND TRANSPORTATION

9.1 INTRODUCTION

The Point Thomson facility will be a remote operating facility that will be approximately 60 miles (100 km) from any existing North Slope road infrastructure. The Badami development approximately 22 mi (35 km) to the west was also developed as a remote facility with no permanent road access due to environmental impact concerns related to a permanent gravel road and the high costs of a road, in particular, the need to construct bridges over the major rivers such as the east channel of the Sagavanirktok. Consequently, permanent road access was likewise deleted from consideration for Point Thomson during the Conceptual Engineering phase. As a result of the Badami and Alpine developments, there is considerable experience in operating and supporting such a remote facility, although specific details relating to transportation and logistics vary among these facilities.

Another important consideration in the logistics and transportation strategy is the plan to construct large process-facility modules, which can only be transported safely and efficiently to Point Thomson by sea lift. Sea barges are typically used to transport large modules[1] and other supplies and equipment to the Alaska North Slope. 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 associated habitat impacts.

Mobilization and supply of the drilling rigs are also important considerations. Again, as with the modules, barge shipment of the rigs and major re-supply by sea offer the most cost-effective transportation method and allows the rigs to be available for an early start. Provision of a dock is thus a vital component of the development plan for Point Thomson.

Year-round access is, however, still essential for the project both for routine operations and in the event of an emergency. Air transportation will be used year-round for personnel, materials, and emergency support when there is no ice road and no barge traffic. The proposed airstrip is therefore sized to handle relatively large aircraft (e.g., Hercules C-130 and Boeing 737) and located inland to maximize weather operability.

It is anticipated that for the first two years a winter ice road will be required for the construction of the gravel pads and airstrip, pipeline construction, delivery of early infrastructure facilities, and the transport of personnel, fuel, equipment, and materials. Ice roads may also be required in subsequent years to support ongoing drilling and plant operations. During the first two summers, barges will be used extensively, as noted above, for transporting drill rigs, major modules, and other equipment, and supplies to the project site.

[1] Large process modules have been selected as the most efficient and economic design to minimize onsite assembly, and to facilitate expeditious commissioning and startup.

The logistics and transportation plan will be refined as engineering and execution planning progress. This planning process will weigh the relative merits and costs of ice road transportation for major consumables, marine transport, and storage onsite. This will provide additional information on project traffic and specific routings.

9.2 SEA LIFT

Large process-facility modules can be transported safely and efficiently only by sea lift. Sea lift is also the most cost-effective mode of transport for the drilling rigs and will allow them to be available to start drilling as early as possible. The shallow approaches to the Point Thomson area preclude beach landings, which are in any case difficult and costly. Provision of a dock is therefore a vital component of the development plan for Point Thomson.

Marine access will be available via the Beaufort Sea only during a mid-July to mid-September weather window to a dock to be constructed as part of the project. The dock will be connected to the central facilities area by a compacted gravel access road. Sea lifts to support construction and drilling are currently planned to take place in the mid-July to mid-September weather windows of 2005 and 2006. Additional sea lifts will be planned for subsequent years when required to support drilling and operations. The special characteristics of the region demand contractors with suitable registered vessels, experience in similar operations in Alaska, and quality control and environmental procedures of the highest standards.

It is anticipated that the first-year inbound loads will include the drilling rigs, bulk materials and some small modules. Outbound loads will include bulk waste and redundant equipment.

It is anticipated that second-year loads will include the facility modules. The return legs of these deliveries will provide the opportunity to re-deploy construction equipment and to remove bulk waste.

9.3 LOCAL MARINE TRAFFIC

In the summers, local barge and small boat traffic will be used as required between the roadheads at Endicott, Prudhoe Bay, and Point Thomson to deliver articles that are too heavy or too large to be shipped by air. This will also provide a timely means to remove waste and redundant equipment.

9.4 AIR TRAFFIC

Air transportation will be used on a year-round basis for personnel, materials, and emergency support during the period when there is no ice road and no sea access. The proposed airstrip therefore will be sized to handle relatively large aircraft (e.g., Hercules C-130 and Boeing 737) and will be located inland to take advantage of better weather conditions.

Until the airstrip is constructed and commissioned, air traffic will be restricted to helicopters. During this early period, helicopters will also provide the only means for rapid medical evacuation and emergencies. After the airstrip is commissioned, fixed-wing aircraft will be the normal route for deployment and rotation of personnel, including emergency medical evacuation.

After construction, aircraft will be the only means of transport in and out of the Point Thomson Unit except during the summer weather window when sea access is available. Preliminary estimates anticipate that several helicopter trips per week, and addition to daily flights by other aircraft will be required to support operations activities. During the construction phase of the project numerous flights per day either by helicopter or fixed-wing aircraft will be required to support activities. The numbers of flights will depend on the activities and the extent of infrastructure in place. Helicopters may also be required for casualty and emergency evacuation during pipeline construction.

9.5 ROAD TRAFFIC

The Badami development approximately 22 mi (35 km) to the west was also developed as a remote facility with no permanent road access due to environmental impact concerns related to a permanent gravel road and to the high costs of a road, in particular, the need to construct bridges over the major rivers such as the east channel of the Sagavanirktok. Consequently, permanent road access was likewise deleted from consideration for Point Thomson during the Conceptual Engineering phase. However, roads will be needed to provide the essential link between the various elements of the facility (i.e., the CPF, the East and West Well Pads, the airstrip, and the gravel mine).

Truck traffic provides the most effective and efficient method of delivering the equipment and material necessary to construct the required infrastructure and to prepare the wellhead and processing sites.

The roadhead at Endicott provides an all-year connection to the existing road system for normal truck and bus traffic. Starting in late November 2004, the project will construct a sea ice road from Endicott to the central site to deploy construction equipment, personnel, camps, and material. These will be mobilized in increments from Endicott as the infrastructure is developed. Several hundred vehicle trips from Endicott to Point Thomson will be required for sea ice road construction and maintenance during the ice road season. It is anticipated that 80 to 150 or more vehicle trips per day will be made on this road during the first year's construction (winter 2004-2005) to transport heavy equipment, materials, construction camps, personnel, etc. to the site.

During pipeline construction in winter of 2005/2006, about 50 to 125 or more vehicle trips per day will be required from the CPF Pad to each of the well pads and about 100 to 150 trips per day or more vehicle trips on an ice road to Badami. A sea ice road will be rebuilt the following year to provide similar road access to complete the initial project development (preliminary drilling) and to provide a route out for redundant equipment.

9.6 INFIELD VEHICLE TRAFFIC

Vehicle traffic will take place on the infield roads as construction of the roads is completed. During summer facilities construction and installation activities, numerous daily vehicle trips can be expected on the infield gravel roads between the pads.

Infield traffic for gravel placement during the January to April 2005 construction period may consist of more than 300 vehicle trips per day on the gravel roads from the gravel mine to the

CPF Pad, airstrip, and dock locations plus another 200 or more gravel-haul trips per day from the CPF Pad to the East and West Well Pads.

Numerous vehicle trips per day on infield roads will also occur during normal operations.

10.0 CONSTRUCTION PLAN

10.1 FIRST-YEAR CONSTRUCTION SCOPE

The objective of the first construction year is to have all required drilling support infrastructure in place by October 2005, the proposed start of development drilling. The scope of work for 2005 includes gravel-mine-site development; construction of all pads, infield roads, the dock, and the airstrip; and installation and commissioning of equipment required to support drilling operations as detailed in Section 4.0.

Most civil construction is planned to take place during the winter using both sea and inland ice roads to minimize impact to the tundra. Construction will be done using proven conventional arctic onshore equipment and techniques. The majority of civil construction is expected to be complete by April 2005, with the exception of final gravel compaction and shaping activities during June to July 2005. By late summer 2005, the dock is expected to be fully operational, and the airstrip is expected to be ready for use by the fall of 2005.

All early infrastructure equipment will be installed and fully commissioned before drilling starts. Construction camps will be provided as stand-alone units with their own water and waste treatment utilities.

10.1.1 Ice Roads

Depending on weather conditions, construction of a grounded-sea-ice road connecting Endicott to Point Thomson could begin late November 2004 and is expected to be completed by late December 2004 to early January 2005. The road will be designed, constructed, and maintained to support the first-year construction effort, including transport of heavy equipment, materials, construction camps, and personnel to the site.

An inland ice road will be built from the dock location to the mine site to facilitate mine development activities. Construction of the inland road will start once construction equipment can be mobilized to the site in early 2005. Fresh water from nearby permitted lakes will be the primary source for inland ice-road construction. Ice chips may also be used to reduce the amount of free water that is withdrawn from the lakes. Ice road maintenance will continue throughout the winter season.

10.1.2 Mine Site Development

Overview

The proposed Point Thomson gravel mine will serve as a major source of gravel for construction of the project facilities and for use as a maintenance stockpile. Other sources will include gravel obtained from nearby abandoned and/or rehabilitated sites. A *Draft Gravel Mining Rehabilitation*

Plan[1] has been prepared to satisfy the regulatory requirements of State of Alaska and federal resource agencies. Information provided in the draft plan, which will continue to be refined based on agency consultation and as final project design evolves, is summarized therein. The information will be updated with additional details of the rehabilitation approach, proposed performance standards, and needed monitoring as project design and execution planning progresses.

The proposed Point Thomson gravel mine site is located approximately 2 mi (3.2 km) south of the Point Thomson Unit #3 exploratory well pad (see Figure 5-2). Preliminary results from a geotechnical investigation conducted in March 2000 indicate the presence of gravel to a depth of 30 ft to 60 ft (9 m to 18 m). The gravel is overlain by an overburden layer of peat and silt that ranges from 3.5 ft and 12 ft (1 m to 4 m) thick. A vegetation analysis conducted for the *Point Thomson Gas Cycling Project Environmental Report*[2] indicates that tundra vegetation types potentially impacted by gravel mine development (including overburden storage area and gravel stockpile) will mainly consist of Moist or Dry Tundra and Wet Tundra, and to a lesser degree Moist/Wet Tundra.

Mining Plan

The Point Thomson gravel mine development pit will be mined on a one-time basis during the first winter construction season. The gravel mine will be located within a 39-acre (16-ha) area to the east of the airstrip access road, west of an unnamed creek, and north of the airstrip (see Figure 7-16). Construction of the project facilities will require approximately 2,000,000 cy (1,530,000 m^3) of gravel, including a 250,000-cy (191,000-m^3) gravel stockpile for future maintenance of roads, pads, and the airstrip.

An overburden storage site has been located between the gravel mine and the airstrip access road (Figure 7-16). It is anticipated that approximately 470,000 cy (360,000 m^3) of overburden will be removed from the 39-acre (16-ha) gravel mine site.

The proposed 11-acre (4.5-ha) gravel stockpile area is located adjacent to the northeast corner of the gravel mine site, with the west side adjoining the airstrip access road (see Figure 7-17). A secondary use of the gravel surface provided by the stockpile is to serve as a storage area. This will be particularly useful during the drilling phase of the project.

The gravel mine site area will be accessed using an ice road or other acceptable tundra travel methods. Overburden material will be removed in a north to south direction for approximately 1,590 ft (485 m) beginning near the western boundary of the gravel mine site and extending east for approximately 1,065 ft (325 m). Blasting may be necessary to aid in overburden removal. Overburden will not be removed from the western bank of the unnamed creek.

Blasting will be conducted in 20-ft (6-m) lifts to loosen material and provide 2-inch-minus gravel material for construction. Gravel mining will be conducted from north to south, with the northern

1 URS Corporation (2002). *Point Thomson Gas Cycling Project Environmental Report Addendum.* Prepared for ExxonMobil Production Company on behalf of the Point Thomson Unit owners by URS Corporation (Anchorage, Alaska). July 31, 2002.

2 URS Corporation (2001). *Point Thomson Gas Cycling Project Environment Report.* Prepared for ExxonMobil Production Company on behalf of the Point Thomson Unit owners by URS Corporation (Anchorage, Alaska). July 30, 2001.

portion of the mine being deepest if required. Gravel extraction within the development pit may be conducted to a depth of -40 ft (-12 m) below mean sea level (MSL), depending on the quality of material available (see Figure 7-17). Gravel mining will not extend into the western bank of the unnamed creek.

It is anticipated that mining will be concentrated in portions of the development pit where the thickest gravel deposits are encountered, resulting in variable post-mining contours. Slopes in the gravel mine pit will be left at angles no steeper than 2:1 to reduce the need for headwall modification or re-contouring for slope stability. If necessary, the boundaries of the gravel mine area will be contoured once mining activities are completed to ensure that spring snowmelt runoff will not carry sediments into the unnamed creek to the east of the site.

10.1.3 Gravel Haul and Placement

Gravel haul and placement activities include gravel mine development to support construction of the roads, pads, airstrip, dock, and gravel stockpile for future road maintenance. Construction activity for field development will begin as soon as possible in the winter of 2004-2005. A sea ice road will be constructed to mobilize equipment and materials to the Point Thomson area.

During the winter months, the gravel mine site will be developed, and gravel from the mine will be used to construct the field facilities (pads, dock, airstrip, infield road system). These gravel structures will have a nominal thickness above the tundra of 6 ft (1.8 m). Side slopes of the roads, pads, and airstrip will be constructed initially to approximately 1.7:1, horizontal to vertical. Following thawing, settling, and final grading, and grooming during the ensuing spring, summer, and fall, the nominal finished thickness of roads, pads, and the airstrip will be 5 ft (1.5 m), and finished side slopes will be nominally 2:1.

Snow and ice will be removed from the tundra surface and stored near the construction sites. Gravel will then be laid, graded, and compacted. Typical construction equipment to be used will include bulldozers, front-end loaders, rollers, trucks, and other heavy equipment. After the spring of 2005, some thawing and subsequent settlement of the gravel structures are expected to occur. These gravel structures will be regraded and recompacted as necessary while they are thawing in the summer of 2005.

Most of the heavy construction equipment will be demobilized from the site via ice road before the ice road is no longer serviceable in late April or early May 2005. Remaining heavy equipment will be demobilized via barge during July and August 2005.

10.1.4 Dock

During the first winter season of construction, the dock will be constructed by flooding as necessary to ground the sea ice, then removing ice in the construction area and disposing of the ice blocks at a suitable location. Gravel will be dumped onto the exposed seabed to form the bulk of the dock structure during the winter. Final dock construction, including installation of the dock hardware (i.e., sheet piles, dock head, etc.), gravel compaction, and shaping for all areas, will continue until the dock is operational in July 2005.

Several options are being considered for establishing a channel to allow barge access to the dock. One option is to dredge a channel during 2005 and 2006 to the 9-ft (3-m) isobath to accommodate unloading of the up to 6,000-ton (5,443-metric-ton) modules. The shallow dredged area is estimated to be approximately 1,000 ft by 400 ft (305 m by 122 m). One or two 10-in. to 12-in. (25-cm to 30-cm) suction dredges would be used. The spoils (up to 30,000 cy [22,940 m^3]) will be loaded onto barges for disposal at sea. Other options being considered are:

- Conducting the initial removal of the material in the winter by cutting the sea ice and excavating with a backhoe and/or clamshell. Subsequently, some additional removal of material might be required in the summer to ensure the channel is at the appropriate depth (either a suction dredge, clam shell/backhoe, or screed barge might be used).
- The initial removal of material in the summer might be done with a clamshell/backhoe instead of a suction dredge.

Additional dredging operations may be required once the channel is established. However, it is believed that screeding (i.e., flattening of the sea floor without actual disposal of material) before module arrival and occasionally afterwards is more likely to be needed than additional dredging.

As soon as possible after breakup, the dredges will be transported by barge to the Point Thomson area and dredging will commence. The operation is expected to take from 3 to 4 weeks and will be completed before start of the fall whale hunt and associated offshore travel restrictions. Up to 30,000 cy (22,940 m^3) of spoils removed during dredging will be placed on barges and transported to a permitted dumpsite.

10.1.5 Infrastructure Installation

The following infrastructure will be installed during the first year when gravel has been placed and suitably compacted:

- Permanent camp,
- Temporary camp,
- Warehouse,
- Utility module,
- Power plant, and
- Telecommunication tower.

10.2 SECOND-YEAR CONSTRUCTION SCOPE

The objective of the second construction year is to install and commission all pipelines, the CPF modules, flare area, well pad facilities, and remaining telecommunications and controls equipment to support first production in the fourth quarter of 2006. Most pipeline construction will be conducted during the winter using both sea and inland ice roads to minimize impact to the tundra. All pipelines will be installed above ground using VSMs.

The construction workforce is expected to peak during the first quarter of 2006 with simultaneous ice road construction and maintenance, drilling operations, pipeline construction, and civil construction works for the CPF modules. Should actual workforce requirements exceed the combined capacity of the construction and permanent camp facilities, camps at existing oil field facilities and in the Deadhorse area may be used for overflow.

Work in the second year will also include installation of facilities at the East and West Well Pads, sealift and installation of the process modules, and commissioning and start-up of the CPF facility.

10.2.1 Ice Roads

Construction of the sea ice road for the second year of construction will be similar to that of the first year. Work will begin in November 2005, weather permitting, with completion in early January 2006. Construction of the inland ice roads for both the infield gathering lines and export condensate pipeline is expected to begin mid-January 2006 based on the anticipated opening date for tundra travel, and should be complete by mid-February 2006.

10.2.2 Pipelines

Pipeline construction is planned to begin mid-January 2006. The scope of work includes the installation of gathering lines from both the East and West Well Pads, high-pressure gas pipelines from the CPF to the CWP Pad, and condensate export pipeline from the CPF Pad to the Badami tie-in. The gathering, infield, and export pipelines will be built mostly during the winter using proven conventional arctic onshore equipment and techniques.

The pipelines will be pre-insulated offsite and trucked to the site on ice roads. All other pipeline materials (VSMs, pipe racks, pipe spools, pig launch and receiver skids, etc.) will be prefabricated and trucked to Point Thomson on ice roads beginning January 2006.

VSM and Pipeline Installation

The pipe laying process will commence in January with surveyors staking the VSM installation positions. VSM holes will be drilled and the tailings cleared. Then VSMs will be strung along the pipeline alignment together with the beams. The VSM assemblies will be set in the holes, which are typically filled with sand/water slurry.

Pipeline road crossings will be installed through casing/culvert that is buried in the road bed gravel, which will be placed on top of the tundra. Figure 6-1 illustrates a typical road crossing.

Upon completion of VSM installation on a segment of the pipeline, joints of pipe will be transported to the site, strung along the pipeline alignment, and welded together to form a continuous string. Each weld produced in the field will be examined by non-destructive testing (NDT). The pipeline strings will then be lifted onto the VSMs, with tie-in welds performed and tested by NDT. Applying insulation to the tie-in welds will conclude the pipe laying activities.

Storage and laydown areas may be required in support of pipeline construction. These areas would be ice pads, snow pads, space on existing gravel pads, or space on new gravel pads to be constructed in the Point Thomson Unit. Information will be provided at a later date regarding the exact location(s) of these storage areas.

Valves and Valve Pads

Additional areas may be required for possible valve installation along the pipeline, if valves are found to be required during the detailed design phase. Location and sizes will be determined as engineering design matures. Any gravel pads needed to support valves will be approximately 5 ft (1.5 m) thick and sides will be sloped nominally at 2:1.

Badami Tie-In

The connection to the Badami pipeline will include valve facilities similar to those typically used in North Slope production and may include a heater.

Pig Launching Facilities

Pig launching and receiving facilities will be provided for the export pipeline. There will be a pig launcher at the Point Thomson CPF and a pig receiver at the Badami CPU or on an adjacent pad. Section 6.0 further describes pipeline monitoring and the use of pigs.

Hydrotesting

The export pipeline will be hydrostatically pressure-tested in accordance with accepted industry codes and regulations. The procedures for hydrostatic testing and caliper pigging of the pipeline have not been established to date. If not completed during the winter construction period, these activities may be performed during the summer and fall before the start of production. Three scenarios are being considered:

- Drawing fresh water from local water sources, and filtering and discharging the water to tundra after hydrotest (as authorized under the applicable National Pollutant Discharge Elimination System [NPDES] permit).
- Using seawater, and filtering and discharging the water back to the ocean after hydrotest (as authorized under the applicable NPDES permit).
- Using a glycol/water mixture, and disposing of the mixture after use in the Point Thomson disposal well or sending it to Prudhoe or other suitable facility for recycling.

10.2.3 Truckable Skids

The smaller facilities and infrastructure to be installed before the sealift of major facilities in 2006 will be prefabricated and assembled into truckable skids. These skids may either be trucked to Point Thomson via ice road in the winter or barged to the site in summer. Examples of equipment and facilities delivered in this fashion include:

- Pipe rack modules,
- Well metering/manifold skids,
- Pig launcher/receiver skids,
- Well lines,
- Methanol tanks and injection skids,
- G&I module,
- Control systems, and
- All yard piping and electrical.

Concurrent construction and drilling activities will take place during installation of the well pad modules. The plan is to have as much equipment installed as feasible prior to the arrival of the CPF modules to maintain an efficient schedule and use of onsite construction manpower.

10.2.4 Commissioning

Process modules will be sealifted and are expected to arrive at the Point Thomson dock by mid-August 2006, assuming timely open-water access to the Beaufort Sea. Three months have been allocated as the minimum time needed to install and commission the first production train to support first production startup as early as the fourth quarter, 2006. The facility will be in full production when the drilling program is completed.

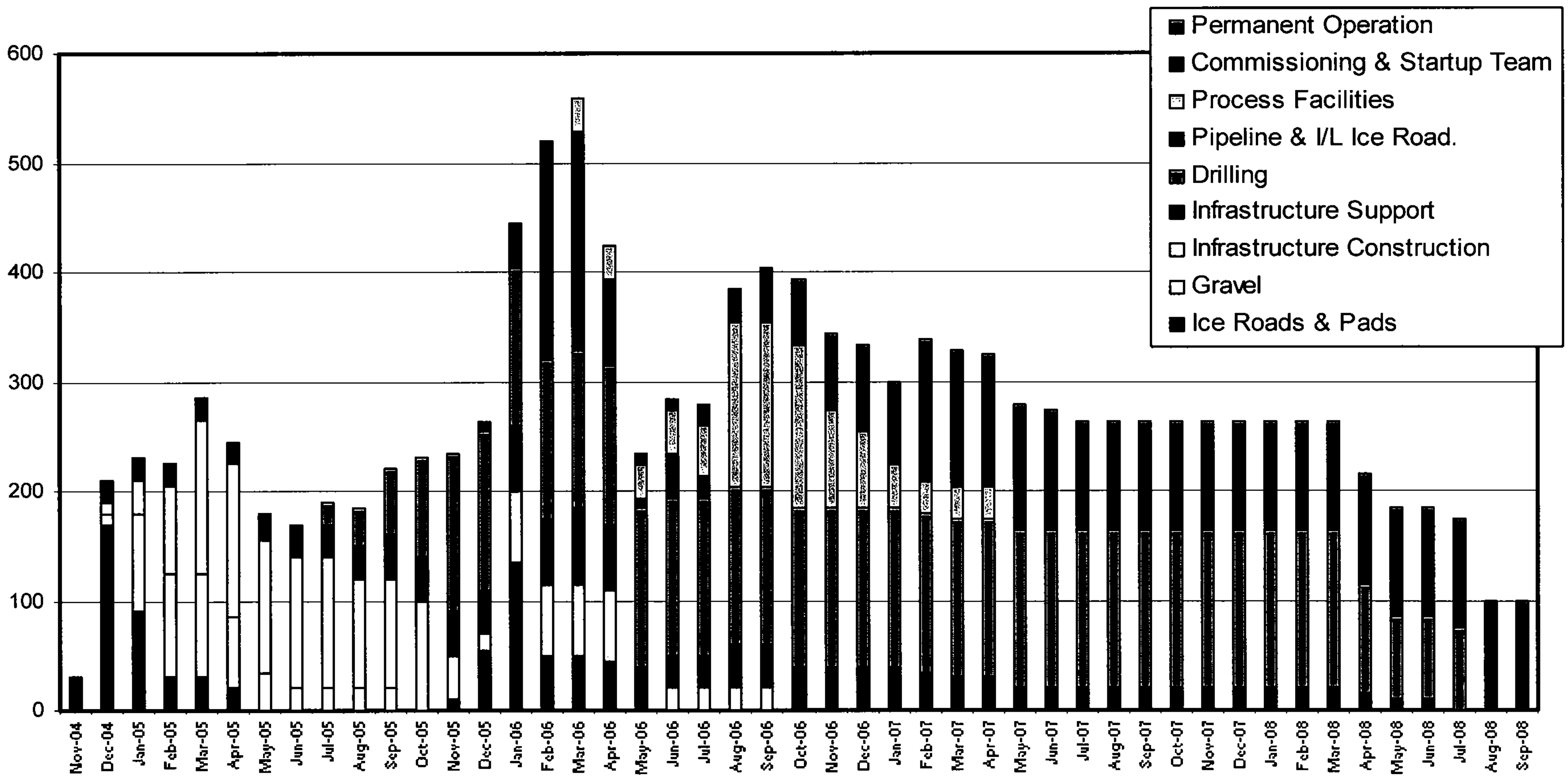
11.0 WORKFORCE

11.1 CONSTRUCTION AND DRILLING

The preliminary total workforce requirement during construction and drilling is expected to peak at more than 500 people (Figure 11-1). This peak is expected in the first quarter 2006 when simultaneous drilling operations, ice road construction, pipeline construction, and civil construction works for the CPF modules occur. Due to the diverse types of work being conducted at multiple locations, the workforce will be billeted at several sites. Bed space at Prudhoe Bay and other existing facilities will be used where appropriate. This plan will minimize travel time to camps as well as mitigate any safety concerns with any portion of the workforce being isolated due to weather.

11.2 OPERATIONS AND MAINTENANCE

The Point Thomson Gas Cycling Project will likely require a permanent workforce of approximately 40 people for general operations and 100 people or more during special work programs (e.g., planned and emergency maintenance operations and workovers). The permanent camp design includes accommodations for 100 beds to account for fluctuations in the workforce. These totals are included in the total labor figures above.



ExxonMobil

POINT THOMSON GAS CYCLING PROJECT TOTAL WORKFORCE PROJECTION BASED ON CONCEPTUAL ESTIMATES

DATE:	SCALE:	FIGURE:
September 2002	N/A	11-1

12.0 SPILL PREVENTION AND RESPONSE

The ODPCP will be developed to cover all site operations and spill response considerations, and will include four major sections:

- *Response Action Plan:* Describes deployment and response strategies for a remote facility and pipeline system, including, but not limited to, information on safety, emergency action checklists, and flow diagrams and incident reporting requirements.
- *Prevention Plan:* Describes regular pollution prevention measures or programs to prevent spills (for example, discussions of tank and pipeline leak detection systems and discharge detection and alarm systems). This section also covers personnel training, site inspections schedules, and maintenance protocols.
- *Supplemental Information:* Describes the facility itself and the environment in the immediate vicinity of the facility. This section also includes information on response logistical support and equipment (mechanical and non-mechanical) and spill response team training.
- *Best Available Technology:* Presents analyses of various technology used and/or available for use at the site for well source control, pipeline source control and leak detection, tank source control, leak detection, liquid level determination and overfill protection, corrosion control and surveys, and mechanical response equipment.

To achieve the spill response capabilities described in the contingency plan, a range of specialized equipment dedicated to oil spill responses will be staged at Point Thomson. ExxonMobil and Alaska Clean Seas (ACS) will jointly develop pre-staged equipment at the central pads (CFP and CWP), West Well Pad, and East Well Pad. In addition, ACS response vessels will use the Point Thomson dock for quick mobilization to potential marine and stream spills.

ACS will serve as Point Thomson's Oil Spill Removal Organization and primary Response Action Contractor, approved by the Alaska Department of Environmental Conservation and the U.S. Coast Guard. As they do for the other North Slope oil production operations, ACS technicians will help assemble, store, maintain, and operate Point Thomson's spill response equipment.

The central pads will store most of the facility's oil spill response equipment, which is expected to include a number of containers holding a variety of boom types, oil skimmers, portable tanks, pumps, hoses, generators, and wildlife protection equipment. Snowmachines and other vehicles for off-road access are expected to be stored on the central pads as well. The CPF will be designed to include facilities to support the emergency response teams at Point Thomson. Thus, the central pads will provide the indoor and outdoor facilities to support emergency responses to oil spills throughout the Point Thomson facilities.

Equipment will be pre-staged at the East and West Well Pads to assist with immediate spill responses there. Each production pad is expected to support a pair of metal container boxes with up to 2,000 ft (610 m) of containment boom and 800 ft (244 m) of absorbent boom, among other spill response gear.

To respond to spills into streams and into the marine environment, spill response vessels will be maintained at Point Thomson during open-water seasons. A landing craft, work skiffs, and airboats capable of traversing the shallow waters common in the area are likely to be staged at Point Thomson. Additional response vessels, for example "Island Class" or "Bay Class" workboats, designed to pull long lengths of oil spill containment boom and operate skimmers are also planned. One or more small barges for storing and hauling oil recovered from marine oil spills also will be staged with the vessels. For the most part, the vessels and barges would be stored on trailers and then launched from the dock.

13.0 WASTE MANAGEMENT PLAN

The primary consideration in waste management strategy is compliance with all applicable federal, state, and local government requirements.

For the Point Thomson Gas Cycling Project, several environmental considerations must be factored into the design of the facilities. The waste management strategy must address:

- Disposal of domestic and production waste streams at a small remote facility,
- Seasonal availability of disposal options,
- Alternatives for waste disposal should a primary system not be available,
- Disposal of wastes uniquely associated with oil and gas production and related processes, and
- Changes in types and quantities of wastes during construction and operations.

Waste minimization, product substitution, beneficial reuse, and recycling will be integral parts of the overall waste management strategy for the project.

The following sections describe the general waste management approach that will be followed during construction, drilling, and operation of the Point Thomson Gas Cycling Project. First, the major regulatory considerations are reviewed and then the approach to meet those regulatory requirements is presented. Section 13.2 provides a listing of the kinds of wastes anticipated for the project, with a brief description of the handling approach for the wastes.

13.1 MANAGEMENT APPROACH

13.1.1 General

The strategy for project waste management consists of waste minimization to the greatest extent possible coupled with onsite disposal wherever practical. The design considerations associated with implementing this strategy include site access, onsite storage capability, and regulatory compliance.

Site access mechanisms vary based on the time of year, and may be severely limited with regard to hauling waste offsite during certain portions of the year. During the open-water season, there will be access to and from the facility by seagoing vessels. During the construction phase of the project, it is envisioned there will be access via an ice road in winter.

Hauling of waste offsite is possible, but not necessarily the most effective option. After initial construction, ice roads will generally not be available for waste hauling during the winter, and in the spring and fall (breakup and freeze-up), access to the site will be limited to air transportation. During these times, waste that cannot be disposed of onsite will be stored for transportation to other disposal facilities during the summer sea-access windows.

Onsite disposal options discussed in this waste management plan will be used to the fullest extent practical. A permanent incinerator will be located onsite to dispose of non-hazardous burnables (wood, food, etc.). Additional temporary incinerators may be used to deal with the high volumes of burnables during construction and drilling activities. There will also be a permanent sewage treatment facility to treat camp wastewater. This will be used before the disposal well is operational and if the disposal well is not available. It is anticipated that the permanent and temporary camps will each have their own sewage treatment facilities.

Another important factor in design considerations associated with Point Thomson waste management is regulatory compliance. It is the project's philosophy to employ waste minimization techniques to the greatest extent possible in our operations and to prevent discharge of drilling wastes or produced fluids. Two permitting activities are being conducted to achieve this waste management strategy for this project.

The first activity includes permitting two Class I non-hazardous waste disposal well locations. The availability of a Class I disposal well will enable the Point Thomson facility to handle essentially all of the drilling waste as well as facility-generated wastewater onsite as opposed to transporting this material to other North Slope facilities. G&I facilities are being incorporated into the execution plan to facilitate handling of drilling muds and cuttings. The application for the UIC Class I Industrial well permit will request approval to dispose of the maximum anticipated volume of waste. The application will request approval for two Class I Industrial wells, to cover the contingency that a redundant well is needed. ExxonMobil is also considering requesting approval for annular injection of drilling wastes to provide waste management flexibility.

The second waste disposal permitting activity is that of obtaining the National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit application will be submitted to the EPA for review and approval. The permit application will address all anticipated effluent streams. The permit will also include occasional discharges associated with testing the fire control system, as well as sanitary and domestic wastes associated with the camp during the occasional times when the Class I disposal well is not available for injection. Storm-water runoff will be permitted under the NPDES Program as surface drainage, and applicable Best Management Practices (BMPs) will be developed to mitigate storm-water contamination. Except for permitted NPDES discharges associated with the Point Thomson facility, no process streams will be designed to discharge into the environment. The majority of facility operations will be located in modules or containment areas where there is little risk of a release.

This Waste Management Plan describes waste disposal options for waste generated during the construction, drilling, and operations phases of the project based on the strategy and design considerations outlined above.

13.1.2 Construction

Winter construction operations will use ice roads and the existing Prudhoe Bay gravel road infrastructure to provide access between the construction locations and existing North Slope waste management facilities. Wastes generated during the initial construction stages of the project, when disposal options are limited at Point Thomson, will be back-hauled to waste facilities for disposal in the Prudhoe Bay area. Wastes generated during early pad and infrastructure construction activities during open water will be consolidated onsite and transported to Prudhoe Bay/Deadhorse and managed at approved facilities or stored onsite until access is available. Additional options for waste disposal will become available as the drilling and operations phases of the project progress.

13.1.3 Drilling

Due to limitations on available space, onsite disposal options for the disposal of drilling wastes will be used to the fullest possible extent. Onsite disposal options include a disposal well, G&I unit, annular injection, and an incinerator.

The Point Thomson G&I facility will be designed to inject ground drill cuttings, waste mud and water from drilling activities, wastewater from construction camp and permanent camp operations, and produced water from operation of the Point Thomson facility. The G&I system may be located at the CWP and in such case cuttings from the East and West Well Pads would be trucked to the G&I facility for processing and downhole disposal. Surface gravel from the upper holes will be washed and used for road and pad maintenance, rather than being processed at the G&I. At the drill site, the larger rock (1/8-in. and bigger is allowed by permits for other recent projects) will be screened out, washed, and spread on the back slopes of existing pads and roads. Annular injection at the East, Central, and West Well Pads will be considered during engineering. This would involve use of a mobile G&I facility located with the drilling rig.

The G&I system has the capacity to grind the remaining cuttings to a 20 mesh size. Each mill train is capable of grinding approximately 6 cy (4.6 m^3) of rock per hour, which is more than 100% of the volume of material expected. It is estimated that approximately 1.1 cy (0.84 m^3) of rock per hour will be produced from each drilling rig operation at Point Thomson.

Grinding and injecting is generally performed in batches with a fixed volume ground up and converted to slurry for injection. The slurry injection pumps with capacities of approximately 125 gallons per minute (473 liters per minute) and maximum discharge pressures of approximately 5,000 psi (34,475 kPa) are typically used (actual injection pressures of 3,000 psi [20,685 kPa] are normal).

A Class I disposal well is the first well scheduled to be drilled. As a contingency, if the Class I permit is not received by the time the well is completed, plans will be in place to permit the well as Class II until the Class I permit is issued. The Class I well will be authorized to receive all non-hazardous Class I fluids and all Class II fluids. A Class II well will be restricted to Class II fluids only. In both cases, operations restrictions on the well may place physical or chemical restrictions on the type of material approved for disposal.

A plant incinerator installed early in the construction process will be used to dispose of wood pallets, mud bags, and other burnable materials. It is likely that the peak use that defines rating and sizing requirements will occur during the construction and drilling phases. Emissions from the incinerator will meet air permit requirements for Prevention of Significant Deterioration (PSD).

13.1.4 Operations

The disposal well, a cuttings G&I unit, and an incinerator will be available as disposal options during operations. Vessels will be used during the open-water period to transport waste material that cannot be disposed of by these means and must therefore be transported from the facility for disposal. This material will be stored until transport options are available or will be carried to Prudhoe Bay/Deadhorse using alternate means of transportation, such as aircraft.

It is anticipated that by the time the operations phase has commenced, the Class I disposal well permit will be in-hand. If the permit has not yet been obtained, Class I fluids will either be reused in the drilling process, back-hauled to existing North Slope facilities, or temporarily stored onsite until the permit is obtained.

The Class I well will require stringent operational and record keeping requirements as mandated by the U.S. EPA. A waste analysis plan, which will include information on waste tracking and waste identification, will be submitted for approval to the EPA before Class I disposal operations begin.

13.2 DISPOSAL OPTIONS

The following discussion of waste disposal options for specific wastes addresses the three phases of the Point Thomson Gas Cycling Project (construction, drilling, operations) unless otherwise identified by waste type.

13.2.1 Non-Hazardous Solid Waste

Non-hazardous solid waste consisting of trash, food wastes, wood debris, metal debris and construction debris will be segregated onsite at main collection points into:

- Burnables (trash, food wastes, wood debris, etc.);
- Landfill (non-burnables); and
- Recyclable metal.

The waste will then be stored in designated dumpsters. Burnables will be transported to processing facilities in Deadhorse, or incinerated at Point Thomson in a permitted incinerator. Landfill and recyclable metal will be transported to Deadhorse facilities for processing.

13.2.2 Oily Trash

Non-hazardous oily trash consisting of oily rags and sorbents, drained oil filters, rags and sorbents with non-hazardous chemicals, oily pit liners, empty oil and grease containers, and oily debris will be collected and stored onsite in designated lined and labeled dumpsters. The waste will be incinerated onsite in a permitted incinerator or transported to Deadhorse facilities for processing.

13.2.3 Oily Solids from Vessels

During the facilities operations phase, oily solids from process tanks, vessels, and lines will require handling and disposal. The oily solids will be slurried and disposed of in the disposal well or transported to other North Slope facilities for injection in an approved disposal well. These types of solids are exempted from hazardous waste determination and will not be tested prior to disposal.

13.2.4 Drilling Mud

Drilling mud generated during drilling operations at Point Thomson will either be disposed of in the permitted Class I disposal well or through annular injection. If neither of these options is available (e.g., for the first well drilled), mud will be stored onsite until disposal is available or transported to existing Prudhoe Bay or Badami facilities for disposal.

13.2.5 Drill Cuttings

Presently it is envisioned that surface hole drill cuttings generated during drilling operations will be washed and stockpiled on the pad for future use. Below surface hole cuttings will be ground and injected as a slurry into the disposal well or into a well annulus. Cuttings may be temporarily stored until a disposal option becomes available.

13.2.6 Non-Hazardous Class I Fluids

Until onsite Class I fluid disposal is available, non-hazardous waste fluids generated during construction will be transported to existing North Slope facilities for disposal under third-party use agreements. The non-hazardous fluids include certain chemicals, tank rinse, sump fluids, and contaminated snowmelt. Approval from the disposal facilities will be obtained prior to transport. Temporary onsite storage consisting of portable tanks or tank trucks may be necessary until approvals are acquired.

After initiation of the drilling phase of the Point Thomson Gas Cycling Project, fluids will be evaluated for reuse in the drilling process. The Class I well will be used for disposal of non-hazardous Class I fluids after the Class I permit is obtained. All materials will be documented to be non-hazardous prior to disposal.

13.2.7 Class II Fluids

Class II fluids, defined as those fluids originating in the well bore (such as produced water, well returns from workovers, and fluids generated from process vessels) will be disposed of in the disposal well. These types of fluids are exempted from hazardous waste determination and will not be tested prior to injection. Certain fluids, such as mud and slurried cuttings, may be disposed of through annular injection.

All volumes of materials injected for disposal will be documented to meet agency reporting requirements.

13.2.8 Recyclable/Reusable Fluids

All fluids consisting of used oils, diesel, glycol, and other hydrocarbons, or chemicals, determined to be recyclable or reusable materials in accordance with state and federal regulations, will be managed as such and not as waste products.

Used oil will be segregated from other materials and stored in containers marked with the words "Used Oil." All used oil will be tested to verify acceptability for recycling and inserted into the crude oil stream at Point Thomson or other North Slope facilities. Testing may consist of a halogens screen and flash point test. Used oil generated during the construction phase will be transported to existing facilities for insertion into the crude oil stream after testing. Used oil generated from a known source with known inputs (such as from a turbine within the facility) will be evaluated for recycling based on Material Safety Data Sheet (MSDS) information.

During the construction and drilling phases of the project, used oil may be burned in a permitted used-oil furnace to provide heat for the shops. All other materials determined to be potentially reusable will, at a minimum, be visually inspected. Suitable materials will be labeled with the container contents and stored until reused. Testing will be conducted on fluids found to be questionable. All materials determined to be unsuitable for reuse or recycling will be managed as a waste material and characterized for disposal.

13.2.9 Hazardous Waste

All wastes determined to be hazardous according to the Resource Conservation and Recovery Act (RCRA) will be managed in accordance with all federal and state guidelines. Hazardous waste will be placed in drums or other approved containers for storage. All containers will be marked with the contents, the date generated, and the words "Hazardous Waste." All containers will be stored in a containment area with an impermeable liner. All hazardous waste will be transported to management facilities located in the Lower 48 for recycling and/or disposal.

RCRA compliance files will be maintained onsite and will include information on waste identification, transportation manifests, and all correspondence with state and federal agencies regarding hazardous waste shipment.

13.2.10 Gray Water

Gray water generated from construction, drilling, and facility operations will be injected into the disposal well, once it is available. Prior to commissioning of the disposal well and during periods when the disposal well is unavailable for injection, gray water will be discharged through an outfall regulated by an NPDES permit after proper treatment by the sewage treatment facility.

13.2.11 Sewage Sludge

Sewage sludge generated from camp operations will either be injected down the Class I disposal well, when it is available, or back-hauled to existing North Slope facilities for treatment and disposal.

13.2.12 Incinerator Ash

Ash generated from waste incinerators will be characterized in accordance with RCRA guidelines. Ash determined to be hazardous will be managed as hazardous waste. Ash determined to be non-hazardous will be transported to Deadhorse facilities for processing, or slurried and injected into the disposal well onsite.

13.2.13 Contaminated Snow

Contaminated snow generated from spill cleanup operations during the operations phase of the project will be melted onsite and injected into the disposal well or other regulatory approved methods. Only non-hazardous meltwater will be disposed of in the well. Snow with the potential for testing as hazardous will be segregated and melted in a designated bin to recover material for reuse.

Contaminated snow generated from spill cleanup operations during the construction and drilling phases of the project may be temporarily stored at the point of generation and/or at a central storage location, or transported as generated to disposal facilities. Storage areas will consist of impermeable containment. During drilling the snow may be melted onsite and reused as a fluid in the drilling process or injected into the disposal well as either a Class I or Class II fluid. Until the Class I permit is obtained, snow contaminated with fluids not suitable for melting and reuse in the drilling process will be transported to existing North Slope facilities for disposal.

Storage logs will be maintained onsite for all material added to containment areas. The information documented will include volume, material spilled, date of generation, and certification that the material is non-hazardous.

Snow contaminated with gravel, soil, trash, wood, and other debris will be staged on-site and melted by natural or mechanical means. All resulting debris will be recovered and disposed of properly.

13.2.14 Contaminated Gravel

Contaminated gravel and soil generated from spill cleanup operations will be remediated onsite or at other North Slope facilities. Gravel will be recovered for pad maintenance or other uses. If needed, storage areas will consist of impermeable containment and will be constructed in accordance with Alaska Department of Environmental Conservation guidelines for storage of contaminated material. Remediation may consist of incineration, washing, and injection or other approved technology.

Storage logs will be maintained onsite for all material added to containment areas. The information documented will include volume, material spilled, date of generation, and verification that the material is non-hazardous.

13.2.15 Naturally Occurring Radioactive Material

Naturally occurring radioactive materials (NORM) may be present in some production facilities and will be properly identified and handled. Well tubulars and piping will be scanned for NORM when they are pulled from a well or removed from the process. Piping and tubulars that show indications of NORM will be stored onsite. When enough NORM-active pipes have been accumulated, they will be transported to a Prudhoe Bay area facility specially designed for NORM removal using high-pressure water. The resultant water-based slurry will be injected in a Class II disposal well.

13.2.16 Special Cases

The items listed below may be used during the construction and drilling phases of the development and, if so, will be managed in accordance with the following procedures indicated for facility operation.

- ***Empty Drums:*** Due to waste minimization efforts and limited storage space, drum stock will be kept to a minimum. Empty drums will be stored onsite and back-hauled to existing North Slope facilities for flushing, crushing, and processing. Empty drum storage will be in secondary containment if there is any threat that residual fluids will be released from the drums or if the physical condition of the drums will result in the contamination of snow or gravel (i.e., the drums are "dirty").
- ***Aerosol Cans:*** Aerosol cans that are completely empty (nothing is heard or felt when shaken) will be placed in a separate non-burnable container or dumpster. Non-empty cans will be punctured and the contents collected using a drum-mounted can crusher. Punctured cans will be placed in the non-burnable container, and the contents will be characterized for disposal. Aerosol cans will not be emptied into facility sumps.
- ***Lead Acid Batteries:*** Lead acid batteries will be segregated from waste streams and stored inside until transported to Deadhorse for exchange for new batteries with the supplier. Lead acid batteries that are not standard size (e.g., from heavy equipment) may not be accepted by suppliers for exchange and may have to be transported to recycling facilities in the Lower 48.
- ***Medical Waste:*** Medical waste will be stored in containers marked "Medical Waste" and will either be burned in the onsite incinerator or sent offsite to a regulated medical waste incinerator for disposal.
- ***Fluorescent Light Tubes:*** Fluorescent light tubes will be collected, crushed into drums or maintained in original packaging, and sent to recycling facilities in the Lower 48. Crushing will be accomplished by using a manually fed drum-mounted unit, which crushes the tubes and deposits the debris in the drum.
- ***Used Oil Filters:*** Used oil filters will be punctured and hot-drained onsite as generated. The collected oil will be screened for halogens and flash point prior to insertion into the crude stream, and the drained filters will be placed in a separate oily trash container or dumpster.
- ***Radioactive Waste:*** All radioactive waste will be characterized for disposal as generated. Common sources of radioactive waste are exit signs and smoke detectors. These materials will be stored in containers with the contents clearly identified.
- ***X-Ray Fluid:*** X-ray fluid will be processed through a silver recovery unit. The silver recovery cartridge will be shipped to an approved offsite reclaimer. The remaining fluid is non-hazardous after recovery of silver and then can be disposed of properly (e.g., in the Class I well).
- ***Hydrotest Fluid:*** Depending on the composition and previous use of the fluid, the following options may exist:
  - Point Thomson disposal well or other approved facility
  - Discharge under NPDES permit
  - Reuse

14.0 TERMINATION

The expected life of the Point Thomson Gas Cycling Project is about 30 years. Abandonment timing will be determined based on the need for the facilities. Detailed abandonment procedures will be developed at the time of project termination. Specific plans will depend on the facilities in place and the specific requirements applicable to those facilities at the time of abandonment.

Abandonment activities will be consistent with lease terms, requirements in the Unit Agreement, permit conditions, and other applicable regulatory requirements. Abandonment plans will be subject to review by multiple agencies, with input from other local, state, and federal agencies, and likely will involve some degree of overlapping authority.