

**FINAL TERMS OF REFERENCE
ENVIRONMENTAL IMPACT ASSESSMENT REPORT**

**FOR THE
PETRO-CANADA
MACKAY RIVER SAGD EXPANSION PROJECT**

Approximately 50 km Northwest of Fort McMurray, Alberta

Issued by: Alberta Environment

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Purpose	1
1.2	Scope of Environmental Impact Assessment.....	1
1.3	Public Consultation	2
1.4	Proponent’s Submission	2
2.0	PROJECT OVERVIEW	2
2.1	The Proponent and Lease History.....	2
2.2	The Project Area and EIA Study Area.....	2
2.3	Project Components and Development Schedule	2
2.4	Project Need and Alternatives	3
2.5	Regulatory Review	3
2.6	EIA Summary	4
3.0	PROJECT DESCRIPTION.....	4
3.1	Site Development	4
3.2	Infrastructure and Transportation	5
3.3	Air Emissions Management.....	6
3.3.1	Greenhouse Gas Emissions	6
3.4	Water and Wastewater Management.....	7
3.4.1	Water Supply	7
3.4.2	Water Management	7
3.4.3	Wastewater Management.....	7
3.5	Hydrocarbon, Chemical and Waste Management	8
3.6	Environmental Management Systems and Contingency Plans.....	9
3.7	Adaptation Planning	10
3.8	Participation In and Monitoring Through Cooperative Efforts	10
3.9	Reclamation (See Appendix).....	10
4.0	ENVIRONMENTAL ASSESSMENT	11
4.1	Assessment Scenarios.....	11
4.2	Assessment Requirements	12
4.3	Modelling	12
4.4	Cumulative Environmental Effects.....	12
4.5	EIA Study Area	13
4.6	Biodiversity and Fragmentation	13
4.6.1	Biodiversity.....	13
4.6.2	Fragmentation	14
4.7	Climate, Air Quality and Noise	14
4.7.1	Climate Change.....	15
4.8	Water Resources.....	15
4.8.1	Hydrogeology	15
4.8.2	Hydrology	16
4.8.3	Surface Water Quality.....	17
4.8.4	Aquatic Ecology.....	17
4.9	Terrestrial	18
4.9.1	Land Use.....	18
4.9.2	Geology, Terrain and Soils	19
4.9.3	Vegetation	20
4.9.4	Wildlife	21
4.10	Traditional Ecological Knowledge and Land Use.....	22
5.0	HISTORICAL RESOURCES AND LAND USE ASSESSMENT	22
6.0	PUBLIC HEALTH AND SAFETY ISSUES	23
7.0	PUBLIC CONSULTATION	23
8.0	SOCIO-ECONOMIC ASSESSMENT	24
	APPENDIX	26
	AIR QUALITY ASSESSMENT	26
	RECLAMATION PLAN.....	26
	WATER SUPPLY, WATER MANAGEMENT AND WASTEWATER MANAGEMENT.....	26
	GROUNDWATER	27
	SURFACE WATER	27

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to identify for Petro-Canada and for the public the information required by government agencies for an Environmental Impact Assessment (EIA) report. Petro-Canada will prepare and submit an EIA report that examines the environmental effects of the construction, operation and reclamation of its proposed MacKay River Expansion (MRE) Project (the Project).

Petro-Canada is proposing to expand its operating MacKay River Project (MRP). The proposed expansion will again be based on steam assisted gravity drainage (SAGD) technology. The proposed expansion will consist of a new central plant which will include a diluent bitumen processing facility, a second water treatment system, a water supply/disposal system which may be tied to a potential new cogeneration unit, coupled with gas fired steam boilers and other utility systems. Some of the originally planned and approved wellpads from MRP will be moved, and four new pads are planned to access additional resource. The proposed expansion would allow for an additional 40,000 barrels of petroleum per day of production to be processed at the new facility. The total design capacity of the existing operation and the proposed second facility is 73,000 barrels of petroleum per day of bitumen. The proposed Expansion Project would be located within the Regional Municipality of Wood Buffalo within Township 93, Ranges 11, 12, W4M.

1.2 Scope of Environmental Assessment Report

The EIA report shall be prepared in accordance with these Terms of Reference and the environmental information requirements prescribed under the *Environmental Protection and Enhancement Act* (EPEA) and Regulations, the *Oil Sands Conservation Act* (OSCA) and Regulations, and any federal legislation which may apply to the Project. The EIA report will:

- a) assist the public and government in understanding the environmental consequences of the Project's development, operation and reclamation plan and will assist Petro-Canada in its decision-making process;
- b) address:
 - i) project impacts,
 - ii) mitigation options, and
 - iii) residual effects relevant to the assessment of the Project including, as appropriate, those related to the other industrial operations;
- c) discuss possible measures, including established measures and possible improvements based on research and development to:
 - i) prevent or mitigate impacts,
 - ii) assist in the monitoring of environmental protection measures, and
 - iii) identify residual impacts and their significance including cumulative and regional development considerations. As appropriate for the various types of impacts, discussion of the impact predictions should be presented in terms of magnitude, frequency, duration, seasonal timing, reversibility and geographic extent;
- d) include tables that cross-reference the report (subsections) to the EIA Terms of Reference and to any current applications submitted pursuant to the EPEA and the *Water Act*; and
- e) include a glossary of terms and list of abbreviations to assist the reader in understanding the material presented.

The EIA report will form part of Petro-Canada's application to the Alberta Energy and Utilities Board (EUB). A summary of the EIA report should also be included as part of the EUB Application document.

1.3 Public Consultation

The preparation of the EIA report will include a public consultation program to assist with project scoping and issue identification, documenting the results of these consultations (see Section 7.0). The public consultation program is to communicate with those members of the public who may be affected by the Project and to provide them with an opportunity to participate in the Environmental Assessment process.

1.4 Proponent's Submission

Petro-Canada is responsible for the preparation of the EIA report and related applications. The final submission will be based upon the Terms of Reference and issues raised during the public consultation process.

2.0 PROJECT OVERVIEW

2.1 The Proponent and Lease History

Provide:

- a) the name of the proponent;
- b) the name of the legal entity that will develop, manage and operate the Project;
- c) a corporate profile; and
- d) an overview of the Project.

Describe Petro-Canada and its history in Alberta's oil and gas industry, with specific reference to the existing Petro-Canada oil and gas developments, proposed developments, resource characterization and environmental studies in the oil sands region.

2.2 The Project Area and EIA Study Area

The Principal Development Area (PDA) includes all lands subject to direct disturbance from the Project and associated infrastructure, including access and utility corridors. For the PDA, provide:

- a) the legal land description;
- b) the boundaries of the PDA;
- c) a map that identifies the locations of all proposed development activities; and
- d) a map showing the area proposed to be disturbed in relation to existing topographic features, township grids, wetlands, watercourses and waterbodies.

Study areas for the EIA report include the PDA and other areas based on individual environmental components where an effect from a proposed development can reasonably be expected. Provide:

- a) the rationale used to define Local and Regional Study Areas (see also Section 4.5), considering the location and range of probable project and cumulative effects including those related to regional or cumulative effects consistent with the direction of the Regional Sustainable Development Strategy (RSDS) process where possible; and
- b) illustrate boundaries and identify Local and Regional Study Areas chosen to assess impacts on maps of appropriate scale.

2.3 Project Components and Development Schedule

Provide a development plan and overview of the project components proposed for approval, including:

- a) the phases of development;
- b) bitumen/heavy oil recovery;
- c) field maintenance operations;

- d) processing facilities;
- e) buildings;
- f) transportation infrastructure; and
- g) utilities.

Provide an outline and drawings of the project components and activities, including:

- a) temporary structures;
- b) processing/treatment facilities;
- c) buildings and infrastructure (roads, pipelines and utilities);
- d) transportation and access roads;
- e) containment structures such as berms and retention ponds;
- f) lime sludge pond(s);
- g) water source wells and intakes;
- h) aggregate resources and other road construction material required and onsite availability;
- i) types and amounts of waste materials, waste storage areas and disposal sites;
- j) activities associated with development of the area, operations, reclamation and development closure; and
- k) proposed method of product transportation to markets.

Provide a development schedule outlining the proposed phasing and sequencing of components, including:

- a) pre-construction;
- b) construction;
- c) operation;
- d) decommissioning;
- e) reclamation;
- f) a detailed schedule for any reclamation and related activities envisaged during the first decade of operations and closure; and
- g) the key factors controlling the schedule and uncertainties.

2.4 Project Need and Alternatives

Discuss the need for the Project and consider the implications of not going ahead with the Project, specifically addressing the following:

- a) any alternative means of carrying out the Project that are technically and economically feasible and where applicable indicate their potential environmental effects and impacts;
- b) compare identified alternatives to the Project and the anticipated environmental effects and impacts of the alternatives. Discuss reasons for not selecting any identified alternatives;
- c) identify potential cooperative development opportunities for the Project; and
- d) implications resulting from a delay in proceeding with the Project, or any phase of the Project.

2.5 Regulatory Review

Provide the following:

- a) identify the environmental and other specific regulatory approvals and legislation that are applicable to the Project at the municipal, provincial and federal government levels;
- b) identify government policies, resource management, planning or study initiatives pertinent to the Project and discuss their implications; and
- c) identify and delineate major components of the Project and identify those being applied for and constructed within the duration of approvals under the:
 - i) EPEA,
 - ii) *Water Act*,

- iii) *Public Lands Act (PLA)*,
- iv) *Canada Fisheries Act*, and
- v) *Navigable Waters Protection Act*.

2.6 EIA Summary

Provide a summary of the EIA report results that includes:

- a) a description of the development activities highlighting those which have the potential to affect the environment;
- b) the existing conditions in the relevant Study Area(s);
- c) any residual effects;
- d) proposed mitigation measures, monitoring and management plans; and
- e) the anticipated environmental effects including cumulative considerations.

List and discuss the key environmental issues and the issues that are important for the achievement of sustainable environmental and resource management that were identified during the preparation of the EIA report and public consultation. Differentiate between emerging issues (with ongoing uncertainties) with quantifiable and significant environmental effects, and issues that can be resolved through available technology and existing management approaches.

3.0 PROJECT DESCRIPTION

Describe activities and components of the Project and relevant management plans. Provide sufficient scope and detail in the project description information to allow quantitative assessment of the environmental consequences. If the scope of information varies among components or phases of the Project, provide rationale demonstrating that the information is sufficient for assessment purposes.

Technical information required in this section may also be required under the EUB technical information requirements or information requirements for an EPEA Approval Application or a *Water Act* Application. Information required in this section may be provided in other parts of Petro-Canada's submission(s) provided that the location of the information is referenced in the EIA report. Petro-Canada should ensure consistency in the information provided whenever it is discussed in more than one section of the submission.

3.1 Site Development

Describe the thermal recovery and other related processes, process facilities and waste management components of the Project, and:

- a) describe how the Project relates to the approved pilot facilities;
- b) provide a map showing any existing infrastructure (e.g., roads) and the location of all existing and proposed facilities;
- c) locate the buildings, road access, pipeline routes, water source wells/intakes, water pipelines, water storage structures, water treatment facilities, utility corridors and waste disposal sites associated with the Project;
- d) describe the process and criteria used to select the sites for facilities and infrastructure for the initial, best known project phases;
- e) show all existing leases and clearings including exploration clearings and illustrate how Petro-Canada intends to use these areas for project development to minimize additional disturbance;
- f) list the facilities for which locations will be determined later;
- g) describe the planned accommodation for the workforce during construction and operations;

- h) provide a description and schedule of land clearing required for:
 - i) central plant facilities,
 - ii) field facilities,
 - iii) well pads,
 - iv) access roads,
 - v) pipelines,
 - vi) borrow areas; and
 - vii) utilities and other site preparation activities;
- i) indicate the amount of surface disturbance from plant, field and infrastructure-related activities including:
 - i) how surface disturbance (extent and duration) will be minimized;
 - ii) opportunities to undertake progressive reclamation to offset new disturbance;
 - iii) whether the timber is merchantable and if so, indicate anticipated volumes and timing of clearing activities; and
 - iv) how visual aesthetics will be managed;
- j) discuss opportunities to integrate the proposed Project with other regional resource development activities (minerals and forestry); and
- k) identify any restrictions and, where appropriate, measures taken to control access to project areas while ensuring continued access to adjacent wildland areas.

3.2 Infrastructure and Transportation

Describe and locate on maps of appropriate scales the infrastructure and transportation (access) requirements for the Project and how it relates to local communities, and:

- a) discuss the amount and source of energy required for the Project;
- b) discuss the options considered for supplying the thermal energy and electric power required for the Project and their environmental implications;
- c) describe road access to and within the Project Area and identify needs to upgrade existing roads or construct new roads;
- d) describe any crossings of watercourses or waterbodies required (with appropriate maps and diagrams). Include:
 - i) timing,
 - ii) construction standards or methods, and
 - iii) environmental protection plans;
- e) discuss the route or site selection criteria for any linear or other infrastructure development or modification and provide the rationale for selecting the proposed alignment and design;
- f) discuss the need for, and plans to, address access management during and after project operations;
- g) provide the results of consultation with Alberta Transportation and discussions with other industry operators;
- h) describe access corridors needed and/or planned by other resource stakeholders including those responsible for Forest Management Areas and other timber quota holders, and those under consideration by the Regional Issues Working Group. Describe how their needs are accommodated to reduce overall environmental impact from resource development. Describe the steps taken to integrate their needs into the location and design of the access infrastructure;
- i) describe the anticipated changes to traffic (e.g., type, and volume) on local highways during the construction and operation of the Project. Discuss any effect expected on the primary and secondary highway system and other regional roads. Consider other existing and planned operations in the region;
- j) identify the type and location of road construction and restoration materials, the volume of material needed and the availability of materials in the area. Discuss how the Project will

affect aggregate reserves that may be located on the company leases and reserves in the region. Provide a plan on how these potentially-affected reserves will be salvaged and stockpiled with input provided by Alberta Transportation and Alberta Sustainable Resource Development;

- k) outline design features to prevent spills, contingencies for spill response and environmental risks associated with spills; and
- l) discuss secondary effects that may result from linear development such as increased hunter, angler and other recreational access and facilitated predator movement.

3.3 Air Emissions Management

Develop an emissions profile (type, rate and source) for each component of the Project including point sources, fugitive emissions, construction and vehicle emissions. Consider both normal operating conditions and upset conditions. Discuss the following:

- a) any National Pollutant Release Inventory (NPRI), Priority Substance List (PSL1), PSL2, and/or Accelerated Reduction/Elimination of Toxics (ARET) substances relevant to the Project;
- b) any odourous or visual emissions from the proposed facilities;
- c) the amount and nature of any acidifying emission, probable deposition patterns and rates and programs Petro-Canada may implement to monitor the effects of this deposition;
- d) control technologies used to minimize air emissions such as sulphur dioxide (SO₂), hydrogen sulphide (H₂S), oxides of nitrogen (NO_x), volatile organic compounds (VOC), and particulate matter;
- e) use of low NO_x technology for boilers. The applicability of the Canadian Council of Ministers of the Environment (CCME) *National Emissions Guidelines for Stationary Combustion Turbines* and CCME *National Emissions Guideline for Commercial/Industrial Boilers and Heaters*;
- f) applicability of sulphur recovery, acid gas re-injection, or flue gas desulphurization to reduce sulphur emissions and applicability of the EUB sulphur recovery guidelines (Interim Directive ID 2001-03);
- g) emergency flaring scenarios (e.g., frequency and duration) and proposed measures to ensure flaring events are minimized;
- h) gas collection, conservation and applicability of technology for vapour recovery for the Project;
- i) fugitive emissions control program to detect, measure and control emissions and odours from equipment leaks and the applicability of the CCME *Code of Practice for Measurement and Control of Fugitive VOC Emissions from Equipment Leaks* and the CCME *Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Above Ground Storage Tanks*; and
- j) describe the monitoring programs Petro-Canada will implement to assess air quality and the effectiveness of mitigation during the Project's development and operation. Discuss how these monitoring programs are compatible with those in use by regional multi-stakeholder air initiatives.

3.3.1 Greenhouse Gas Emissions

Provide the following:

- a) the expected annual and total greenhouse gas (GHG) emissions over the construction, operation and decommissioning phases of the Project;
- b) the Project's marginal contribution to total provincial and national GHG emissions on an annual basis;
- c) the intensity of GHG emissions per unit of product produced and discuss how it compares with similar projects and technology performance;

- d) how the project design and GHG management plans have taken into account the need for continuous improvement with respect to GHG emissions and their consideration of the national *Climate Change Plan for Canada* and *Alberta's Climate Change Action Plan*; and
- e) Petro-Canada's overall GHG management plans, any plans for the use of offsets, (nationally or internationally) and the expected results of implementing the plans.

3.4 Water and Wastewater Management

3.4.1 Water Supply

Describe the water supply requirements for the Project, including, but not limited to, the following:

- a) the annual and seasonal water balance prior to the project development and the expected water balance during project operations. Discuss assumptions made or methods chosen to arrive at the water balances;
- b) the process, potable and non-potable water requirements and sources for construction, start-up, normal and emergency operating situations, decommissioning and reclamation. Include a description of the criteria for selecting the preferred source;
- c) the variability in the amount of water required on an annual and seasonal basis as the Project is implemented and report the expected cumulative effects on water losses/gains due to the project operations. Show the location of sources/intakes and associated infrastructure (pipelines);
- d) describe contingency plans for water supply, including the potential effects of extended periods of drought on the proposed water supply;
- e) indicate options for using non-potable groundwater and provide the criteria used to assess the feasibility of its use; and
- f) describe Petro-Canada's research and piloting of less water intensive technologies.

3.4.2 Water Management

Provide a Water Management Plan for construction, operation and reclamation phases, including, but not limited to, the following:

- a) factors considered in the design of water management systems, such as:
 - i) site drainage,
 - ii) road and well pad run-off,
 - iii) containment,
 - iv) erosion control,
 - v) slumping areas,
 - vi) groundwater protection,
 - vii) groundwater seepage,
 - viii) potable water,
 - ix) produced water, and
 - x) flood protection;
- b) measures for ensuring efficient use of water including alternatives to reduce freshwater consumption such as water use minimization, recycling, and conservation;
- c) permanent or temporary alterations or diversions to watercourses, wetlands including bogs and fens and other waterbodies; and
- d) potential downstream impact if water is removed from local surface waterbodies.

3.4.3 Wastewater Management

Provide a Wastewater Management Plan to address site runoff, groundwater protection, deep well disposal and wastewater discharge, including, but not limited to, the following:

- a) source, quantity and composition of each wastewater stream from the existing and proposed facilities;

- b) NPRI, PSL1, PSL2, or ARET substances relevant to the Project;
- c) design of facilities that will handle, treat, store and release wastewater streams;
- d) type and quantity of chemicals used in water and wastewater treatment;
- e) options considered for treatment, wastewater management strategies and reasons (including water quality and environmental considerations) for selecting the preferred options (consider the Industrial Release Limits Policy when determining whether either technology or water quality standards will define acceptable release limits);
- f) the discharge of aqueous contaminants (quantity, quality and timing) beyond plant site boundaries and the potential environmental effects of such releases;
- g) formations for the disposal of wastewaters, including:
 - i) formation characterization,
 - ii) local and regional hydrodynamic flow regime,
 - iii) water quality,
 - iv) chemical compatibility,
 - v) containment potential within the disposal zones, and
 - vi) injection capacity;
- h) the chemical composition of disposal waters;
- i) wastewater disposal alternatives;
- j) current and proposed monitoring programs;
- k) potable water and sewage treatment systems that will be installed as components of the Project for both the construction and operation stages; and
- l) the principles that have been incorporated into the project design for pollution prevention, waste minimization and recycling.

3.5 Hydrocarbon, Chemical and Waste Management

Characterize and quantify the anticipated hazardous, non-hazardous, recyclables and dangerous goods wastes generated or used by the Project. Demonstrate that the selected management options are consistent with the current regulatory requirements and industry practices, and address the following specifics:

- a) describe the composition and volume of specific waste streams generated by the Project, and identify how each stream will be managed. Demonstrate that the selected practices for the plant and field operations comply with provincial and federal regulations including EPEA's Waste Control Regulation and Alberta Environment's *Hazardous Waste Storage Guidelines*;
- b) provide a listing of chemical products to be used for the Project. Identify products containing substances that are:
 - i) *Canadian Environmental Protection Act* (CEPA) toxics,
 - ii) on the PSL2 or ARET, and those defined as dangerous goods pursuant to the federal *Transportation of Dangerous Goods Act*. Classify the wastes generated and characterize each stream under the Alberta Environment *User's Guide for Waste Managers*,
 - iii) on the NPRI, and
 - iv) on Track 1 substances targeted under Environment Canada's Toxic Substances Management Policy for virtual elimination from the environment;
- c) describe, in general terms, how these items will be stored and managed. Identify how future changes to this slate of chemical products will be handled to ensure adequate protection to both the environment and to employee health and safety;
- d) identify the location, nature and amount of onsite hydrocarbon storage. Discuss containment, spill prevention and other environmental protection measures. Discuss how selected practices comply with provincial and federal regulations including the EUB Guide 55 - Storage Requirements for Upstream Petroleum Industry;
- e) identify the amount of drilling wastes produced by the Project, the options considered for disposal and the option(s) chosen. Determine the amount of surface disturbance caused by

- drilling waste disposal and describe any mitigative options to reduce the disturbance. Describe how the disposal sites and sumps will be constructed in compliance with the Oil and Gas Conservation Regulation;
- f) identify the type and amount of water softening sludge associated with the Project, if any. Describe disposal plans;
 - g) discuss the strategy for onsite waste disposal versus offsite waste disposal and identify:
 - i) the location of onsite waste disposal, including landfills, if applicable,
 - ii) the suitability of the site(s) from a groundwater protection perspective (provide geotechnical information to support the siting of disposal facilities), and
 - iii) potential effects on the environment; and
 - h) describe plans for waste minimization, recycling, and management over the life of the Project. Discuss methods and technologies to reduce waste quantities to the lowest practical levels.

3.6 Environmental Management Systems and Contingency Plans

Summarize key elements of Petro-Canada's environment, health and safety management system and discuss how the system will be integrated into the Project, addressing the following:

- a) outline plans for monitoring all inputs of the Project and associated facilities. Discuss the key elements of the operating plans and performance standards to be developed prior to the commissioning of the plant, such as:
 - i) policies and corporate procedures,
 - ii) operator training,
 - iii) emergency reporting procedures for spill containment and management, and
 - iv) emergency response, public notification protocol and safety procedures;
- b) describe plans to minimize the production or release into the environment of substances that may have an adverse effect, including:
 - i) modifying existing plans, or
 - ii) developing a conceptual contingency plan that considers environmental effects associated with operational upset conditions such as serious malfunctions or accidents that represent deviations from normal operating performance;
- c) review proposed monitoring, including:
 - i) monitoring done independently by Petro-Canada,
 - ii) monitoring performed in conjunction with other stakeholders,
 - iii) publicly-available monitoring information, and
 - iv) new monitoring initiatives that may be required as a result of the Project;
- d) address air emissions, water emissions, waste tracking, process inputs and outputs. Present conceptual contingency plans that consider the environmental effects of serious malfunctions or accidents;
- e) discuss how regional environmental management initiatives will be incorporated into Petro Canada's management practices;
- f) include an emergency response system to deal with emergency situations and minimize adverse environmental effects, while protecting the safety of personnel. Comment on contingency plans that have been or will be developed to respond to unpredicted negative impacts that are realized during and after project development; and
- g) provide a fire control plan highlighting:
 - i) measures taken to ensure continued access for firefighters to adjacent wildland areas,
 - ii) forest fire prevention measures,
 - iii) measures for determining the clearing width of power line rights-of-way, and
 - iv) using the FireSmart Wildfire Assessment System, assess areas adjacent to the proposed facilities to identify required mitigative measures.

3.7 Adaptation Planning

Describe adaptive management plans that minimize the impact of the Project at the design stage. Describe how the adaptive management plans will be used throughout the life of the Project to site facilities and infrastructure associated with future phases of the Project.

3.8 Participation In and Monitoring Through Cooperative Efforts

Document Petro-Canada's involvement in regional cooperative efforts to address environmental and socio-economic issues associated with oil sands development during the life of the Project, including:

- a) Petro-Canada's current and planned participation in regional initiatives such as the Regional Issues Workshop Group (RIWG), Fort McKay First Nation (Fort McKay-IRC), Boreal Caribou Committee (BCC), Cumulative Environmental Management Association (CEMA), the Wood Buffalo Environmental Association (WBEA) and the Regional Aquatics Monitoring Program (RAMP). Include Petro-Canada's participation in regional air, water and other environmental monitoring programs, health studies, research, traditional ecological knowledge (TEK) and socio-economic studies;
- b) potential cooperative ventures that Petro-Canada has initiated, could initiate or could develop with other oil sands operators and other resource users (minerals and forestry) to minimize the environmental impact of the Project or the environmental impact of regional oil sands development;
- c) how Petro-Canada will work to develop and implement such cooperative opportunities;
- d) describe monitoring activities that will be undertaken to assist in managing environmental effects, confirm performance of mitigative measures and improve environmental protection strategies. Discuss how any result will contribute to Petro-Canada's participation in regional efforts;
- e) describe how Petro-Canada will rely upon CEMA, WBEA, RAMP, and CONRAD (Canadian Oilsands Network for Research and Development) to design and implement mitigation measures (to mitigate project specific effects and cumulative effects), monitoring programs (project specific monitoring and regional monitoring), and research programs; and
- f) describe how Petro-Canada would design and implement mitigation measures (to mitigate project specific effects and cumulative effects), monitoring programs (project-specific monitoring and regional monitoring), and research programs outside of these initiatives where necessary.

3.9 Reclamation (See Appendix)

Provide a conceptual reclamation plan for the Project with consideration of the following:

- a) reclamation requirements specified by relevant regulatory organizations and stakeholder preferences;
- b) pre-development information with respect to land capability, vegetation, commercial forest land base by commercialism class, forest productivity, recreation, wildlife, aquatic resources, aesthetics, TEK and land use resources;
- c) project development phasing, and reclamation sequencing for each phase of development;
- d) integration of operations, reclamation planning and reclamation activities;
- e) a revegetation plan for the disturbed terrestrial and aquatic areas, identifying the species types that will be used for seeding or planting, and the vegetation management practices. Include the rationale for selection based on the need for the development of self-sustaining biologically diverse ecosystems consistent with the appropriate sub-region of the Boreal Forest Natural Region with reference to the use of native vegetation species;
- f) soil and reclamation material salvage, soil storage areas and soil handling procedures;
- g) areas of soil replacement indicating depth, volume and type of reclamation material;
- h) identify any soil-related constraints or limitations that may affect reclamation;

- i) re-establishment of self-sustaining topography, drainage and surface watercourses and vegetation communities representative of the surrounding area;
- j) pre-development and final reclaimed site drainage plans;
- k) management of waste, wastewater, and other waters;
- l) restoration of pre-development traditional use with consideration for traditional vegetation and wildlife species in the reclaimed landscape;
- m) post-development land capability;
- n) post-development reforestation and forest productivity, with information required for inclusion into the Forest Management Agreement (FMA) Detailed Forest Management Plan;
- o) wetlands or other alternatives to reclaim the land;
- p) a detailed monitoring plan (including soils, vegetation, wildlife and aquatic resources) with schedules and methodologies to measure and evaluate reclamation performance and success;
- q) reporting of reclamation progress through development of the Project, relating reclamation progress to pre-development expectations;
- r) discuss the conceptual reclaimed landscape design with reference to the following:
 - i) appropriate productivity equivalent to pre-development levels having regard for regulatory requirements and stakeholder end land use preferences,
 - ii) promotion of biodiversity,
 - iii) integration and interconnectivity to the surrounding landscapes,
 - iv) integrating surface and near-surface drainage within the development area,
 - v) incorporating into project planning and development,
 - vi) resemblance to the pre-disturbed landscape,
 - vii) anticipated timeframes for completion of reclamation phases and release of lands back to the Crown, including an outline of the key milestone dates for reclamation and a discussion of how progress will be measured in the achievement of these targets. Discuss any constraints to reclamation such as timing of activities, availability of soil materials and influence of natural processes and cycles, and
 - viii) development of a conceptual ecological land classification (ELC) map for the post-reclamation landscape considering all potential land uses and how the landscape and soils have been designed to accommodate future land use.

4.0 ENVIRONMENTAL ASSESSMENT

4.1 Assessment Scenarios

Define assessment scenarios including:

- a) a Baseline Case*, which includes existing environmental conditions, existing and approved projects or activities;
- b) an Application Case**, which includes the Baseline Case plus the Project; and
- c) a Cumulative Effects Assessment (CEA) Case, which includes past studies, existing and anticipated future environmental conditions, existing projects or activities, plus other or planned*** projects or activities.

Note*: For the purposes of defining assessment scenarios, “approved” means approved by any federal, provincial or municipal regulatory authority. The Baseline Case will include only the portion of the approved MRP that was constructed to March 31, 2005.

Note**: The Application Case will include the as-yet unconstructed portion of the already approved MRP.

Note***: “Planned” is considered any project or activity that has been publicly disclosed prior to the issuance of the Terms of Reference or up to six months prior to the submission of the Project Application and EIA report, whichever is sooner.

4.2 Assessment Requirements

Provide information on the environmental resources and resource uses that could be affected by the construction, operation, and reclamation of the Project:

- a) provide a sufficient base for the prediction of positive and negative impacts and the extent to which negative impacts may be mitigated by planning, project design, construction techniques, operational practices and reclamation techniques. Impact significance will be quantified where possible and assessed including consideration of spatial, temporal and cumulative aspects;
- b) discuss the sources of information used in the assessment including a summary of previously-conducted environmental assessments related to Petro-Canada's operations:
 - i) identify any limitations or deficiencies that the information may place on the analysis or conclusions in the EIA report. Discuss how these limitations or deficiencies will be addressed within the current EIA report,
 - ii) information sources will include literature and previous EIA reports and environmental studies, operating experience from current oil sands operations, industry study groups, traditional knowledge and government sources, and
 - iii) identify where deficiencies in information exist, provide justification for the deficiencies, and describe Petro-Canada's plan, including rationale, for providing the necessary information. Where required, undertake studies and investigations to obtain additional information for establishing a sound baseline for the Study Area;
- c) from a broad-based examination of all ecosystem components including previous environmental assessment work, describe and rationalize the selection of environmental attributes, parameters, or properties examined;
- d) for each selected environmental attribute, parameter, or property:
 - i) describe existing conditions. Comment on whether the available data are sufficient to assess impacts and mitigative measures. Identify environmental disturbance from previous activities that have now become part of the baseline conditions,
 - ii) describe the nature and significance of the environmental effects and impacts associated with the development activities,
 - iii) present plans to minimize, mitigate, or eliminate negative effects and impacts. Discuss the key elements of such plans,
 - iv) identify residual impacts and comment on their significance,
 - v) present a plan to identify possible effects and impacts, monitor environmental impacts, and manage environmental changes to demonstrate the Project is operating in an environmentally-sound manner. Identify any follow-up programs necessary to verify the accuracy of the environmental assessment and to determine the effectiveness of any measures taken to mitigate any adverse environmental effects; and
- e) present a plan that addresses the adverse impacts associated with the Project that may require joint resolution by government, industry and the community. Describe how this plan will be implemented and how it will incorporate the participation of government, industry and the community.

4.3 Modelling

Provide justification for the models selected and document any assumptions used to obtain modelling predictions submitted as part of the EIA report. Clearly identify the limitations of the model(s) including sources of error and relative accuracy.

4.4 Cumulative Environmental Effects

Assessment of cumulative effects will be an integral component of the EIA report. Conduct a cumulative environmental effects assessment of the Project based on the EUB/AENV/NRCB Information Letter "Cumulative Effects Assessment in Environmental Impact Assessment

Reports under the Alberta Environmental Protection and Enhancement Act,” June 2000. Include a summary of all proposed monitoring, research and other strategies or plans to minimize, mitigate and manage any potential adverse effects. The identification and assessment of the likely cumulative environmental effects of the Project will:

- a) define the spatial and temporal Study Area boundaries with due consideration for the RSDS and CEMA recommendations, and provide the rationale for assumptions used to define those boundaries for each environmental component examined;
- b) describe the current (baseline) state of the environment in the Regional Study Area (used for the cumulative effects assessment);
- c) assess the incremental consequences that are likely to result from the Project in combination with other existing, approved and planned projects in the region. A “planned” project is considered any project or activity that has been publicly disclosed prior to the issuance of the Terms of Reference or up to six months prior to the submission of the Project Application and EIA report, whichever is sooner;
- d) demonstrate that relevant information or data used from previous oil sands and other development projects is appropriate for use in this EIA report;
- e) consider and describe deficiencies or limitations in the existing database for relevant components of the environment; and
- f) explain the approach and methods used to identify and assess cumulative impacts, including cooperative opportunities and initiatives undertaken to further the collective understanding of cumulative impacts, and provide a record of relevant assumptions, confidence in data and analysis to support conclusions.

4.5 EIA Study Area

The EIA Study Area shall include the PDA and associated infrastructure, as well as, the spatial and temporal areas of individual environmental components outside the project boundaries where an effect can be reasonably expected. The EIA Study Area includes both Regional and Local Study Areas.

Illustrate boundaries and identify the Study Area(s) chosen to assess impacts. Define temporal and spatial boundaries for the Study Areas. Maps of these areas shall include township and range lines for easy identification and comparisons with other information within the EIA report. Describe the rationale and assumptions used in establishing the EIA Study Area boundaries, including those related to cumulative effects.

4.6 Biodiversity and Fragmentation

4.6.1 Biodiversity

Using the definition for biodiversity provided in the Canadian Biodiversity Strategy (1995), determine and describe the metrics that will be used to assess biodiversity in terrestrial and aquatic ecosystems in order to characterize the existing ecosystems and probable effects of project development, and that will be used to represent broad taxonomic assemblages, and:

- a) describe the process and rationale used to select biotic and abiotic indicators for biodiversity;
- b) within selected taxonomic groups, determine the relative abundance of species in each ecological unit (e.g., ecosite phase). Provide species lists and summaries of observed and estimated species richness and evenness for each ecosite phase;
- c) ensure that baseline information collected in each terrestrial and aquatic community is accompanied by sufficient plots in each ecosite phase to provide statistically sound data using a suitable proportional sampling method;
- d) provide a measure of biodiversity on baseline sites that are representative of the proposed reclamation ecosites;

- e) rank each ecological unit for biodiversity potential by combining measures of species richness, overlap in species lists, significance of individual species or associations, uniqueness and other appropriate measures. Describe the techniques used in the ranking process;
- f) discuss the contribution of the Project to any anticipated changes in regional biodiversity including measures to minimize such change;
- g) discuss how changes in biodiversity could potentially impact local and regional ecosystems; and
- h) discuss biodiversity monitoring programs and management thresholds that Petro-Canada will implement either individually or in cooperation with other operators or regional initiatives.

4.6.2 Fragmentation

Determine the current and proposed level of habitat fragmentation for the Study Areas. Discuss project design approaches that minimize habitat fragmentation. Describe the techniques used in the fragmentation analysis. Describe the principle factors contributing to fragmentation. Identify and evaluate the extent of potential effects from fragmentation (e.g., potential introduction of non-native plant species on native species composition and any changes to plant communities) that may result from the Project.

4.7 Climate, Air Quality and Noise

Discuss climatic and air quality conditions considering existing and approved emission sources (baseline case) alone and in combination with the Project's proposed emissions (Application Case). Review current and approved emission sources and discuss changes as a result of anticipated future development scenarios within the EIA Study Areas. Consider emission point sources as well as fugitive emissions. Identify components of the Project that will affect air quality from local and regional perspectives, and:

- a) discuss appropriate air quality parameters such as SO₂, H₂S, total hydrocarbons (THC), NO_x, VOCs, individual hydrocarbons of concern in the THC and VOC mixtures, ground-level ozone (O₃), visibility, representative heavy metals, and particulates (road dust, PM₁₀ and PM_{2.5});
- b) discuss the formation of secondary pollutants such as ground-level O₃, secondary particulate matter, and acid deposition;
- c) estimate ground-level concentrations of appropriate air quality parameters. Discuss any expected changes to particulate deposition or acidic deposition patterns. For any case of acid deposition modelling, provide deposition data from maximum levels to areas with 0.17 keq H⁺/ha/y Potential Acid Input (PAI) including analysis of PAI deposition levels consistent with the CEMA acid deposition management framework. Justify the selection of the models used and identify any model shortcomings or constraints on findings. Complete modelling in accordance with Alberta Environment's *Air Quality Modelling Guidelines*; March 2003;
- d) identify the potential for reduced air quality (including odours and visibility) resulting from the Project and discuss any implications of the expected air quality for environmental protection and public health;
- e) discuss interactive effects that may occur as a result of co-exposure of a receptor to all emissions and discuss limitations in the present understanding of this subject;
- f) describe air quality impacts resulting from the Project, and their implications for other environmental resources, including habitat diversity and quantity, vegetation resources, water quality and soil conservation;
- g) describe how air quality impacts resulting from the Project will be mitigated;
- h) identify ambient air quality monitoring that will be conducted during construction and operation of the Project;

- i) assess the cumulative effects on the air quality of the Study Areas and include any related emission increases from adjacent operations and publicly-disclosed projects in the area;
- j) identify any regional air monitoring underway in the area and describe Petro-Canada's participation in any regional forums; and
- k) identify components of the Project that have the potential for creating increased noise levels and discuss the implications and measures to mitigate. Present the results of a noise assessment (as specified by the EUB ID 99-8, Noise Control Directive). Include:
 - i) potentially-affected people and wildlife,
 - ii) an estimate of the potential for increased noise resulting from the development,
 - iii) the implications of any increased noise levels, and
 - iv) proposed mitigation measures.

4.7.1 Climate Change

Discuss the following:

- a) review and discuss climate change and the local and/or regional, inter-provincial/territorial changes to environmental conditions resulting from climate conditions, including trends and projections where available;
- b) identify stages or elements of the Project that are sensitive to changes or variability in climate parameters. Discuss what impacts the change to climate parameters may have on elements of the Project that are sensitive to climate parameters; and
- c) comment on the adaptability of the Project in the event the region's climate changes. Discuss any follow-up programs and adaptive management considerations.

4.8 Water Resources

4.8.1 Hydrogeology

Provide an overview of the existing geologic and hydrogeologic setting in the Project and Study Areas from the ground surface down to and including the oil producing zones and disposal zones. Document any new hydrogeological investigations, including methodology and results, undertaken as part of the EIA Study. Provide details on the observation well network used to calibrate any modelling efforts used in this assessment. If figures, maps, diagrams, interpretations and concepts developed from previous work are submitted in the EIA report, demonstrate how, or if, they have been modified by the incorporation of any subsequent new data, and:

- a) present Regional and PDA-specific geology using structure contour maps, geologic cross-sections and isopach maps to illustrate depth, thickness and spatial extent of lithology, stratigraphic units and structural features including water table and potentiometric surfaces;
- b) present Regional and PDA-specific hydrogeology describing:
 - i) the spatial distribution of aquifers and aquitards, their properties and the hydraulic connections between hydrostratigraphic units (include local and regional hydrostratigraphic cross sections),
 - ii) the hydraulic head, hydraulic gradients and groundwater flow directions and velocities,
 - iii) the chemistry of groundwater including background concentrations of major ions, metals and hydrocarbon indicators,
 - iv) the potential discharge zones, potential recharge zones and sources, areas of groundwater-surface water interaction and areas of Quaternary aquifer-bedrock aquifer interaction,
 - v) all water well development and groundwater use, including an inventory of all groundwater users,
 - vi) the recharge potential for Quaternary aquifers,
 - vii) the potential hydraulic connection between bitumen production zones and other aquifers,

- viii) the locations of major facilities associated with the Project including facilities for waste storage, treatment and disposal (e.g., deep well disposal),
- ix) the site-specific aquifer, shallow groundwater and geotechnical conditions beneath these proposed facilities. Identify the components and activities of the Project which have the potential to affect groundwater resource quantity and quality within the Study Areas during project development, operation and reclamation;
- c) describe the nature and significance of the potential project effects on groundwater with respect to:
 - i) inter-relationship between groundwater and surface water in terms of surface water quantity and quality,
 - ii) implications on terrestrial or riparian vegetation, wildlife and aquatic resources including wetlands,
 - iii) changes in groundwater quality,
 - iv) conflicts with other groundwater users, and proposed resolutions to these conflicts, and
 - v) potential implications of seasonal variations; and
- d) describe programs to manage and protect groundwater resources including, but not limited to:
 - i) monitoring programs, and
 - ii) response plans that may be considered in the event that adverse effects on groundwater and/or groundwater users are detected.

Discuss the cumulative effects of groundwater withdrawal by Petro-Canada and other groundwater users with respect to the Study Areas and the PDA.

4.8.2 Hydrology

Describe the surface hydrology in the Study Areas, including existing flow regimes of streams in the PDA and:

- a) provide available local and regional surface flow baseline data, including low, average and peak flows for key creeks, river locations, and low, average and peak levels for key lakes:
 - i) describe and map the drainage patterns in the Study Areas, and
 - ii) provide a topographic map of the Local Study Area with appropriate contour intervals;
- b) identify the extent of changes that will result from disturbances to groundwater and surface water movement:
 - i) include changes to the quantity of surface flow, water levels and channel regime in local watercourses (during minimum, average and peak flows) and water levels in local waterbodies,
 - ii) assess the potential impact of any alterations in flow on the local and regional hydrology and identify all temporary and permanent alterations, channel realignments, disturbances and surface water withdrawals, their magnitude, duration, frequency, and proposed mitigation measures,
 - iii) discuss both the project and cumulative effect of these changes on hydrology (e.g., timing, volume, peak and minimum flow rates, river regime and lake levels), including the significance of effects for downstream watercourses,
 - iv) discuss the potential for connection between surface water, groundwater, production zones and disposal zones,
 - v) identify any potential erosion problems in the local creek channels due to existing or proposed project activities, and
 - vi) discuss remedial measures to alleviate the anticipated erosion;
- c) discuss changes to watershed(s), including surface and near-surface drainage conditions, potential flow impediment, and potential changes in open water surface areas caused by construction of access roads, drilling and well pads, and other facilities;

- d) discuss how potential impacts of temporary and permanent roads and well pads on peatland/wetland types will be minimized, mitigated and monitored. Discuss plans to return disturbed areas to a self-sustaining habitat considering previous capability, biodiversity and land uses;
- e) discuss changes in sediment concentrations in receiving waters caused by construction and describe mitigation measures to reduce sediment loadings;
- f) if any surface water withdrawals are considered, describe the effects of withdrawal, including cumulative effects. Identify any users who have existing approvals, permits or licenses and impact on users due to the Project. Identify any potential water use conflicts and potential solutions;
- g) describe water management plans, mitigation measures and monitoring programs, including participation in regional initiatives, for surface water recommended for the start-up, operations, and reclamation phases; and
- h) identify and discuss any monitoring programs that may be considered to assess the impacts of potential changes to surface water on aquatic resources, wildlife and vegetation.

4.8.3 Surface Water Quality

Describe the baseline water quality of watercourses and waterbodies in the Study Areas before and after project development and operation. The description of water quality will consider all appropriate water quality parameters, their seasonal variations and relationships to flow and other controlling factors, and a summary of existing water quality data, and:

- a) identify components within each phase of the Project that may influence or impact surface water quality;
- b) describe the potential impacts of the Project on surface water quality within the Study Areas:
 - i) discuss any changes in water quality resulting from the Project that may indicate a potential adverse effect or non-compliance with the *Surface Water Quality Guidelines for Use in Alberta* (November 1999) or the *Canadian Water Quality Guidelines*,
 - ii) discuss the significance of any impacts on water quality and implications to aquatic resources (e.g., biota, biodiversity and habitat),
 - iii) assess the potential project related and cumulative impacts of acidifying and other air emissions on surface water quality;
 - iv) the distinction between natural variation and project-related impacts to water quality; and
 - v) discuss the effect of water quality in surface waterbodies due to the change in surface runoff or groundwater discharge;
- c) describe the proposed mitigation measures to be considered, during the construction, operation and reclamation phases of the Project, to maintain surface water quality. For any monitoring implemented for the Project, justify the selection of monitoring locations, and the integration of these sites into an overall aquatic assessment and monitoring program. Describe how the methods are in accordance to Alberta Environment standards for surface water quality monitoring. Identify any cooperative monitoring and assessment initiative(s), such as with regional stakeholders, that Petro-Canada may consider joining; and
- d) discuss the potential effects of seasonal variations and weather extremes on surface water quality. Describe the cumulative effects of regional activities on surface water quality in the Study Areas.

4.8.4 Aquatic Ecology

Describe the existing fish and other aquatic resources (e.g., benthic invertebrate and aquatic vegetation) in the waters found in the Study Area and in other fish-bearing water likely to be

impacted by the Project. Identify species composition, distribution, relative abundance, movements and general life history parameters, and:

- a) discuss the use of the fish resources as existing or potential Aboriginal, sport or commercial fisheries;
- b) describe and map, as appropriate, the fish habitat and aquatic resources of the lakes, rivers and other waters likely to be affected by the Project, and:
 - i) identify key indicator species and provide the rationale and selection criteria used,
 - ii) identify critical or sensitive areas such as spawning, rearing, and over-wintering habitats. Discuss seasonal habitat use including migration and spawning routes,
 - iii) describe the existing baseline information, any deficiencies in information, how these deficiencies will be addressed and, as applicable, any studies proposed to evaluate and monitor the status of the fish and aquatic resources in the Study Areas,
 - iv) describe the potential for adverse impacts on the lakes and streams in the area (e.g., stream alterations and changes to substrate conditions, water quality and quantity affecting fish, fish habitat, and other aquatic resources in the Study Areas),
 - v) consider fish tainting, survival of eggs and fry, chronic or acute health effects, and increased stress on fish populations from release of contaminants, sedimentation, flow alterations and habitat changes, and
 - vi) potential impacts on riparian areas that could impact aquatic biological resources and productivity;
- c) discuss, as applicable, the design, construction and operational factors to be incorporated into the Project for the protection of fish resources. Identify residual impacts on fish, fish habitat, and aquatic communities and discuss their significance in the context of local and regional fisheries. Identify plans proposed to offset any loss in the productivity of fish habitats. Indicate how environmental protection plans address applicable provincial and federal policies on fish habitat including the development of a “No Net Loss” fish habitat objective;
- d) discuss the potential for increased fishing pressures in the region that could arise from the increased workforce and improved access as a result of the Project. Identify the implications for the fish resource and describe any mitigation strategies that might be planned to minimize these effects;
- e) discuss, as appropriate, any cooperative mitigation strategies that might be planned or continued with other oil sands and industrial operators;
- f) assess potential cumulative effects of the Project in combination with other proposed developments in the area on the fish and fish habitat resources of the Study Area; and
- g) identify and discuss, as applicable, any monitoring programs that have been initiated by Petro-Canada or conducted in cooperation with stakeholders to assess fisheries impacts from the Project. Provide details of any programs and discuss how they would contribute to an overall understanding of Project impacts on fish resources.

4.9 Terrestrial

4.9.1 Land Use

Identify the existing recreational, commercial, residential, institutional and traditional land uses, including oil and gas development, agriculture, forestry, tourism, cultural use, food collection, trapping, fishing, hunting and other outdoor recreational activities. Identify the potential impact of the Project on these land uses and possible mitigative strategies, including:

- a) identify any anticipated impacts related to changes in public access;
- b) identify any land use policies and resource management initiatives that pertain to the Study Area and discuss how the proposed development will be consistent with the intent of the guidelines and objectives of these initiatives;
- c) discuss the implications of those land and resource use policies for the Project, including any constraints to development;

- d) identify unique sites or special features in the Study Area such as Natural Areas, Environmentally Significant Areas, Heritage Rivers or Special Places candidate sites, and any potential impacts of the Project on these features;
- e) outline the process for addressing the needs of other users in the Local Study Area;
- f) describe the impact of development and reclamation on commercial forest harvesting in the PDA. Include opportunities for timber salvage, revegetation, reforestation and harvest for the reduction of fuel hazard; and
- g) discuss implications of the Project individually and in combination with other existing and planned developments for regional recreational activities, public access and other land uses during and after development activities, including:
 - i) how regional environmental management initiatives from RSDS and CEMA will be incorporated into Petro-Canada's land use plan,
 - ii) identifying measures to mitigate impacts created on land use by the Project. Identify anticipated impacts on public access for land use in the region, and
 - iii) discussing how reclamation will restore existing land use potentials considering any recommendations of the Reclamation Advisory Committee that are applicable to in-situ oil sands operations.

4.9.2 Geology, Terrain and Soils

Provide the geological, terrain and soils conditions for the Study Areas, including the following:

- a) describe surficial geology including surface topography of the Study Areas and the bedrock;
- b) describe and map the soil types and their distribution in the PDA and Local Study Area using appropriate survey intensity levels. Provide an ecological context to the soil resource by supplying a soil survey report and maps following the Soil Survey Handbook, Volume 1 (Agriculture Canada 1987) to include Survey Intensity Level (SIL) 1 for the development footprint;
- c) describe the local and regional soils that could be affected by the Project with emphasis on potential acidification (by soil type). Identify these soils with a soil map. Use modelled predictions of acid deposition patterns from the Project to assess the potential acidification impact on soils in the Local and Regional Study Areas. Discuss the potential cumulative effects of acid deposition as related to this project and suggest possible mitigation actions;
- d) provide an inventory of the pre- and post-disturbance land capability classes for soils in the Local Study Area and describe the impacts to land capability due to the Project. Identify the distribution and areas of pre-disturbance land capability classes on a map, and indicate the areas and locations of soil types and land capability classes that will be disturbed. Suggest ways in which surficial disturbances can be minimized;
- e) describe the suitability and availability of soils within the PDA for reclamation. Outline the criteria to be used in salvaging soils for reclamation and provide a soil balance for the Project;
- f) provide an assessment of the anticipated changes (type and extent) to baseline topography, elevations and drainage patterns within the Project Area resulting from disturbance during construction, operation and reclamation;
- g) present baseline biophysical information in a manner that enables an ELC of the PDA to be completed to the boreal ecosite classification;
- h) identify and locate erosion sensitive soils, discuss potential effects of the Project on these soils, and suggest mitigative actions;
- i) discuss any project activity and other related issues that could affect soil quality in the Study Areas (e.g., compaction, contaminants or other limitations to achieving vegetation restoration based on anticipated soil conditions);
- j) identify the environmental effects of proposed drilling methods on the surface landscape, surficial and bedrock geology over the life of the Project. Consider the potential for new or

- additional technology to increase resource recovery at later stages of the field development and to affect the number of wells required;
- k) discuss the potential for casing failures and their environmental effects. Identify measures to reduce the environmental risks from casing failures. Describe methods of detecting casing failures and propose an action plan in the event of a casing failure; and
 - l) discuss the potential for changes in the ground surface during operations (e.g., ground heave and ground subsidence). Summarize applicable experience with surface heaving and subsidence and the factors involved in their occurrence. Describe the environmental implications of any terrain or temperature changes during the steaming and recovery operations. Identify any activities with respect to drilling methods that may cause soil contamination and describe mitigative actions.

4.9.3 Vegetation

Map and describe vegetation communities affected by the Project using the *Alberta Vegetation Inventory Standards Manual* (AVI) Version 2.1, and according to the *Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald, 1996), and:

- a) map and describe peatlands and wetlands affected by the Project according to the *Alberta Wetlands Inventory Standards Manual* (AWI) Version 1.0;
- b) address the adequacy of the Study Areas, information sources and assessment methods for a cumulative effects assessment;
- c) describe how baseline information was collected to enable a detailed ELC of the Local Study Area to be completed;
- d) identify and verify the relative abundance of species of rare plants and the ecosite phases where they are found, using reliable survey methods. Discuss any potential effects the Project may have on rare plants or endangered species, as listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Alberta Natural Heritage Information Centre (ANHIC), for each landscape unit;
- e) discuss the ecosites in consideration of their potential to support rare plant species, plants for traditional and medicinal purposes, old growth forests and communities of limited distribution. Consider their importance for local and regional habitat, sustained forest growth, rare plant habitat and the hydrologic regime;
- f) where landscape units are identified as rare, or where a significant percentage of a specific type may be removed by the Project from within the Local Study Area, describe their regional significance;
- g) identify the amount of vegetation and wetlands to be disturbed during each stage of the Project;
- h) discuss temporary (include timeframe) and permanent changes to vegetation and wetland communities:
 - i) comment on the significance of the effects and their implications for other environmental resources (habitat diversity and quantity, water quality, erosion potential, soil conservation, recreation and other uses),
 - ii) comment on the sensitivity to disturbance (including acid deposition), as well as the techniques used to estimate sensitivity to disturbance and reclamation, of each vegetation community and discuss permanent and temporary changes;
- i) produce an ELC map that shows the pre-disturbance and reclaimed land surfaces. Comment on the importance of the size, distribution and variety of these landscape units from both a local and regional perspective;
- j) determine the distribution and relative abundance of wetlands in the Local Study Area;
- k) predict the anticipated effect of the Project on wetlands in conjunction with other project-induced variations in hydrology;

- l) discuss the impact of any loss of peatlands or surface wetlands, as well as how this will affect land use, fragmentation and biodiversity. Discuss measures and techniques that will be used to minimize the impact;
- m) determine the amount of commercial and non-commercial forest land base that will be disturbed by the Project. Compare the pre-disturbance and reclaimed percentages and distribution of all forested communities in the PDA. Provide Timber Productivity Ratings for the Local Study Area lands, including identification of productive forested, non-productive forested and non-forested lands;
- n) determine how the project disturbance impacts Annual Allowable Cuts and quotas within the FMA. Discuss opportunities to integrate this project with other resource development activities such as logging;
- o) provide a detailed mitigation strategy that will minimize project impacts in the Study Areas;
- p) discuss plans to return disturbed areas to a self-sustaining habitat equivalent to pre-disturbance conditions, considering factors such as biological capability and diversity and end land use objectives;
- q) develop a plan to mitigate the adverse effects of site clearing on rare plants and plant communities. Identify any setbacks proposed around environmentally sensitive areas such as surface waterbodies, riparian areas and peatlands/wetlands. Discuss the potential for rare plant species to be restored;
- r) comment on the significance of the residual effects on vegetation resources, peatlands and wetlands, and their implications for other environmental resources; and
- s) in addition to equivalent land capability principle, discuss from an ecological perspective the expected timelines for establishment and recovery of vegetative communities and the expected differences in the resulting vegetation community structures.

4.9.4 Wildlife

Describe existing wildlife resources (amphibians, reptiles, birds and terrestrial and aquatic mammals), their use and potential use of habitats in the Study Areas. Document the anticipated changes to wildlife in the Study Areas. Specifically:

- a) discuss the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) identify key indicator species and provide rationale and selection criteria. Identify composition, distribution, relative abundance, seasonal movements, movement corridors, habitat requirements, key habitat areas, and general life history in the Study Areas. Address those species listed by Alberta Fish and Wildlife (at risk, may be at risk and sensitive species in the *General Status of Alberta Wild Species* 2000), COSEWIC (endangered, threatened, vulnerable in Canadian Species at Risk 2002), relevant species identified by CEMA and important traditional use species;
- c) include field data, using recognized sampling protocols;
- d) evaluate potential impacts on wildlife populations, habitat use, habitat availability/quality and food supply during all phases of the Project. Consider habitat loss, abandonment, reduced effectiveness, fragmentation or alteration as it relates to reproductive potential and recruitment for regional wildlife populations over the life of the Project. If habitat models are used to evaluate impacts, the models will be modified/calibrated by comparing model predictions with wildlife data from the Study Areas;
- e) describe the spatial and temporal changes to habitat (type, quality, quantity, diversity and distribution) and to wildlife distribution, relative abundance, movements, habitat availability and the potential to return the area to pre-disturbed wildlife habitat/population conditions, including:
 - i) anticipated effects on wildlife as a result of changes to air, water, including both acute and chronic effects on animal health,

- ii) anticipated effects on wildlife due to improved or altered access into the area; e.g., vehicle collisions with wildlife, obstructions to daily or seasonal movements, predation, noise and hunting mortality during operations and after project reclamation, and
- iii) anticipated effects of habitat fragmentation and the implications to wildlife, by mapping the changes anticipated by the Project and other planned activities on a local and regional scale;
- f) discuss the use of setbacks to provide for the protection of riparian habitats, interconnectivity of such habitat and the unimpeded movement by wildlife species using the habitat;
- g) indicate what measures will be taken to prevent habituation of wildlife and increasing the potential for human-wildlife encounters and consequent destruction of wildlife, including any staff training program, garbage containment or regular follow-up;
- h) provide an impact assessment for wildlife in the Study Areas. Identify residual impacts to wildlife and wildlife habitat and discuss their significance in local and regional contexts; and
- i) provide a strategy and mitigation plan to minimize impacts on wildlife habitat through the life of the Project and to return productive wildlife habitat to the area, considering:
 - i) habitat enhancement measures and a schedule for the return of habitat capability to areas impacted by the Project,
 - ii) consistency of the plan with applicable regional, provincial and federal wildlife habitat objectives and policies,
 - iii) the need for access controls or other management strategies to protect wildlife during and after project operations, and
 - iv) monitoring programs to assess wildlife impacts from the Project and the effectiveness of mitigation strategies and habitat enhancement measures, giving special attention to sensitive species in the Study Areas.

4.10 Traditional Ecological Knowledge and Land Use

Provide detail on the consultation undertaken with Aboriginal communities with respect to TEK and traditional land use:

- a) provide results of consultation with Aboriginal stakeholders to determine the extent of traditional land use of the Local Study Area. Discuss the vegetation and wildlife used for nutritional and medicinal purposes, and any potential effects the Project may have; and
- b) identify the traditional land uses including fishing, hunting, plant harvesting (nutritional or medicinal), and cultural use with specific regard given to local Aboriginal stakeholders. Identify cabin sites, spiritual sites and graves. Determine the project and cumulative impact of development on these uses and identify possible mitigation strategies.

5.0 HISTORICAL RESOURCES AND LAND USE ASSESSMENT

Detail consultation with Alberta Community Development and Aboriginal communities and provide a Historical Resource Impact Assessment (HRIA) for the Project. Provide Alberta Community Development with a copy of the HRIA report, and:

- a) provide a general overview of the results of any previous historical resource studies that have been conducted in the Study Area, including archaeological resources, palaeontological resources, historical period sites, and any other historical resources as defined within the *Historical Resources Act*:
 - i) summarize the results from the field program performed to assess archaeological, palaeontological and historical significance of the Project, and
 - ii) provide an outline of the program and schedule of field investigations that may be required to further assess and mitigate the effects of the Project on historical resources;

- b) document any stakeholder concerns with respect to the development of the Project based on the historical significance of the Study Areas; and
- c) identify the land uses including oil sands development, fishing and hunting. Determine the impact of development on these uses and identify possible mitigation strategies.

6.0 PUBLIC HEALTH AND SAFETY ISSUES

Describe those aspects of the Project that may have implications for public health. Determine whether there may be implications for public health arising from the Project. Specifically:

- a) identify and discuss the data and methods Petro-Canada used to assess impacts of the Project on human health and safety;
- b) assess the potential health implications of the compounds that will be released to the environment from the proposed operation in relation to exposure limits established to prevent acute and chronic adverse effects on human health;
- c) identify the human health impact of the potential contamination of country foods and natural food sources taking into consideration all project activities;
- d) provide the information on samples of selected species of vegetation known to be consumed by humans;
- e) discuss the potential to increase human exposure to contaminants from changes to water quality, air quality and soil quality taking into consideration all project activities;
- f) during consultation on the project, document any health concerns identified by Aboriginal stakeholders due to the impacts of existing industrial development and of the Project specifically on their traditional lifestyle. Determine the impact of the Project on the health of Aboriginal stakeholders and identify possible mitigation strategies;
- g) assess the cumulative health effects that are likely to result from the Project in combination with other existing, approved and planned projects;
- h) identify, as appropriate, the anticipated follow-up work, including regional cooperative studies. Identify how such work will be implemented and coordinated with ongoing air, soil and water quality initiatives;
- i) identify and discuss the potential health and safety impacts due to higher regional traffic volumes and the increased risk of accidental leaks and spills;
- j) document the health and safety concerns raised by stakeholders during consultation on the Project;
- k) provide a summary of Petro-Canada's emergency response plan and discuss mitigation plans to ensure workforce and public safety during pre-construction, construction, operation and reclamation of the Project. Include prevention and safety measures for wildfire occurrences, accidental release or spill of chemicals to the environment and failures of structures retaining water or fluid wastes;
- l) describe how local residents will be contacted during an emergency and the type of information that will be communicated to them; and
- m) describe the existing agreements with area municipalities or industry groups such as safety cooperatives, emergency response associations and municipal emergency response agencies.

7.0 PUBLIC CONSULTATION

Document the public consultation program implemented for the Project including methods, the type of information provided and the level and nature of Petro-Canada's response, and provide the following:

- a) describe the consultative process and show how public input was obtained and addressed;
- b) document individual participation and attendance at each meeting and record specific comments or issues raised by individuals present at the meetings;

- c) describe and document the concerns and issues expressed by the public, Petro-Canada's analysis of those concerns and issues, and the actions taken to address those concerns and issues;
- d) describe how resolution of the concerns and issues was incorporated into the project development, impact mitigation and monitoring;
- e) describe plans to maintain the public consultation process following completion of the EIA review to ensure that the public will have an appropriate forum for expressing their views on the ongoing development, operation and reclamation of the Project; and
- f) the EIA report will document the public consultation process, record any concerns or suggestions made by the public and will demonstrate how these concerns have been addressed. Consultation will include discussions with:
 - i) Alberta provincial representatives,
 - ii) federal government representatives,
 - iii) residents of Conklin, Chard, Janvier, Fort McMurray, the Regional Municipality of Wood Buffalo and others as identified during the consultative process,
 - iv) First Nations and Métis organizations,
 - v) commercial, industrial, recreational and traditional users, and
 - vi) other potentially-affected parties.

8.0 SOCIO-ECONOMIC ASSESSMENT

Provide information on the socio-economic effects of the Project. Specifically address the following:

- a) document baseline (existing) socio-economic conditions and trends (e.g., changes in population and labour force) for the region and for communities within the region;
- b) identify any concerns related to socio-economics that have been raised by the local municipality or any other stakeholder in the region;
- c) provide information on the socio-economic impacts of the Project and, where appropriate, discuss mitigation plans related to:
 - i) local employment opportunities and training,
 - ii) local business opportunities and procurement,
 - iii) stresses placed on local and regional infrastructure and community services,
 - iv) housing and availability of affordable housing,
 - v) medical facilities and health services,
 - vi) traffic and traffic safety,
 - vii) effects on recreational activities,
 - viii) effects on trapping, hunting and fishing,
 - ix) effects on First Nations and Métis, and
 - x) regional and provincial economic benefits;
- d) if a construction camp is needed, identify its location, the number of workers it is intended to house and outline what services will be provided in the camp (e.g., security, recreation and leisure and medical);
- e) summarize Petro-Canada's policies and programs regarding the use of regional and Alberta goods and services;
- f) provide a summary of estimated industrial benefits including Alberta, other Canadian, and non-Canadian percentages of total project cost for engineering and project management, equipment and materials, construction labour and total overall project;
- g) provide a description of the overall engineering and contracting plan for the Project;
- h) discuss the timing of workforce requirements for construction and operation. Include a breakdown of the total number of jobs to be created along with a description of when peak activity periods will occur;

- i) outline current and ongoing plans to work with Aboriginal stakeholders and other local residents and local businesses with regards to employment, training needs, and other economic development opportunities arising from the construction and operation of the Project;
- j) describe and discuss the impacts of the proposed Project on the availability of affordable housing and the quality of health care services. Identify and discuss the mitigation plans that will be undertaken to address these issues. Provide a summary of any discussions that have taken place with the Municipality and Regional Health Authority concerning housing availability and health care services respectively;
- k) evaluate the need for additional public services or infrastructure taking into consideration the potential for overlap with other projects that are reasonably anticipated during the life of the Project. This will include consideration of housing, transportation, education/training, health and social services, urban and regional recreation use, municipal infrastructure, medical facilities, health services, law enforcement and emergency preparedness; and
- l) provide an analysis of the significance of socio-economic impacts, discuss strategies to mitigate the socio-economic impacts and document any steps that have been undertaken by industry and the Regional Municipality of Wood Buffalo and provincial government and others to identify and address socio-economic concerns.

APPENDIX

The following information is necessary to be submitted as part of the Application under the EPEA. The information may not be necessary for consideration as part of the EIA report completeness decision-making process under Section 53 of EPEA. Upon review of the information submitted, a final determination will be made if it is necessary for the following information to be considered as part of the EIA report completeness decision.

AIR QUALITY ASSESSMENT

Provide via modelling maximum ground-level concentration locations of nitrogen dioxide (NO₂) and SO₂ near the vicinity of the central processing facility, plant or project. Provide ground-level concentrations in 50 or 100 m increments extending out from the central processing facility to 2 or 5 km.

RECLAMATION PLAN

The reclamation plan in the Application will address the following:

- a) provide a soil conservation and reclamation plan for progressive reclamation in the Project Areas. Outline the anticipated major timelines for reclamation activities with reference to the life span of the proposed Project;
- b) provide details about soil salvage indicating areas where salvage will occur (for the well pads, transportation routes, and any other similar activities), the depth and volume of soil to be salvaged, soil storage locations and methods and relate the information to predevelopment conditions;
- c) provide details on area of soil replacement indicating techniques, timing, depth, volume and type of reclamation material;
- d) discuss the potential to retain coarse woody debris for use in reclamation and to reduce the need for slash burning after clearing;
- e) provide information about the reclaimed topography for well pads, roads, and facilities. Identify contouring objectives, drainage restoration (surface and near-surface flow) and erosion control;
- f) discuss the methods that may be used to deal with potential soil compaction and contamination problems in the Project Areas;
- g) identify the location and distribution of post-disturbance land capability on this map;
- h) compare the pre-disturbance and post reclamation percentages and distribution of all forested communities in the Local Study Area;
- i) provide a timber salvage plan, highlighting end land users and identifying proposed volumes for removal by species and year for the Project. Provide a tracking mechanism to ensure the appropriate utilization of the timber volumes by species to salvage per year, or periodically as the Project progresses. Include opportunities for timber salvage, revegetation, reforestation and harvest for the reduction of fuel hazards;
- j) provide a weed management plan including provisions such as those outlined in the *Guidelines for Weed Management in Forestry Operations* (Forest Management Division Directive - 2001-06). This will detail how Petro-Canada will prevent the establishment and control the spread of restricted and noxious weeds (as listed in the *Alberta Weed Control Act*) within the PDA; and
- k) provide appropriately scaled maps of the area highlighting (where possible) the preceding points.

WATER SUPPLY, WATER MANAGEMENT AND WASTEWATER MANAGEMENT

Provide the following information:

- a) how the water requirements for the Project will be met, including annual volumes from each source (for groundwater sources, consider Alberta Environment's *Groundwater Evaluation Guideline*);
- b) the design details of facilities that will handle, treat and store wastewater streams and runoff and include appropriate annual volumes;

- c) the type and quantity of any chemicals used in water/wastewater treatment; and
- d) design details for the potable water and sewage treatment systems for both the construction and operation stages.

GROUNDWATER

Provide a detailed plan and implementation program for the protection of groundwater resources, addressing:

- a) a groundwater monitoring program for early detection of potential contamination and assistance in remediation planning;
- b) groundwater remediation options to be considered for implementation in the event that adverse effects are detected; and
- c) a program to monitor the sustainability of groundwater production.

SURFACE WATER

Provide a detailed plan and implementation program for the protection of surface water addressing:

- a) a surface water monitoring program to assess the performance of water management systems; and
- b) a water quality monitoring program for relevant substances.