

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

**FOR THE PROPOSED**  
**IMPERIAL OIL RESOURCES**  
**KEARL OIL SANDS PROJECT**

**Approximately 70 km North of Fort McMurray, Alberta**

**ISSUED BY:** Alberta Environment

**DATE:** April 22, 2004

## TABLE OF CONTENTS

<b>1.0 INTRODUCTION .....</b>	<b>1</b>
1.1 THE EIA REPORT .....	1
1.2 PUBLIC CONSULTATION .....	1
1.3 PROPONENT'S SUBMISSION .....	1
<b>2.0 PROJECT OVERVIEW .....</b>	<b>1</b>
<b>3.0 REGULATORY AND PLANNING FRAMEWORK.....</b>	<b>1</b>
3.1 EIA SUMMARY .....	2
<b>4.0 PROJECT DESCRIPTION AND MANAGEMENT PLANS.....</b>	<b>2</b>
4.1 PROJECT NEED AND ALTERNATIVES CONSIDERED.....	3
4.2 PROJECT COMPONENTS AND SITE SELECTION .....	3
4.3 PROCESS SELECTION AND DESCRIPTION .....	4
4.4 MATERIALS STORAGE.....	5
4.5 UTILITIES AND TRANSPORTATION.....	5
4.6 WATER SUPPLY, WATER MANAGEMENT AND WASTEWATER MANAGEMENT (SEE APPENDIX) .....	6
4.7 AIR EMISSIONS MANAGEMENT .....	7
4.8 HYDROCARBON, CHEMICAL AND WASTE MANAGEMENT .....	7
4.9 ENVIRONMENTAL MANAGEMENT SYSTEM AND CONTINGENCY PLANS .....	8
4.10 ADAPTION PLANNING .....	8
4.11 RECLAMATION AND CLOSURE (SEE APPENDIX) .....	9
4.12 PARTICIPATION IN REGIONAL COOPERATIVE EFFORTS .....	10
<b>5.0 ENVIRONMENTAL ASSESSMENT .....</b>	<b>10</b>
5.1 BASIC INFORMATION REQUIREMENTS FOR THE ENVIRONMENTAL ASSESSMENT .....	10
5.2 STUDY AREAS.....	12
5.3 CUMULATIVE ENVIRONMENTAL EFFECTS ASSESSMENT .....	12
5.4 CLIMATE, AIR QUALITY AND NOISE .....	12
5.5 LAND USE, ACCESS TO PUBLIC LANDS AND AGGREGATE RESOURCE CONSERVATION.....	13
5.6 TERRESTRIAL AND AQUATIC ECOSYSTEMS.....	14
5.6.1 <i>Biodiversity</i> .....	14
5.6.2 <i>Geology, Soils, Terrain</i> .....	14
5.6.3 <i>Vegetation</i> .....	15
5.6.4 <i>Wildlife</i> .....	16
5.6.5 <i>Groundwater (see Appendix)</i> .....	17
5.6.6 <i>Surface Water</i> .....	19
5.6.7 <i>Aquatic Resources</i> .....	20
<b>6.0 ENVIRONMENTAL MONITORING .....</b>	<b>21</b>
<b>7.0 PUBLIC HEALTH AND SAFETY .....</b>	<b>22</b>
<b>8.0 HISTORICAL RESOURCES AND TRADITIONAL LAND USE.....</b>	<b>22</b>
<b>9.0 SOCIO-ECONOMIC FACTORS.....</b>	<b>23</b>
<b>10.0 PUBLIC CONSULTATION REQUIREMENTS.....</b>	<b>23</b>
<b>APPENDIX .....</b>	<b>24</b>
<i>Water Supply, Water Management and Wastewater Management</i> .....	24
<i>Groundwater</i> .....	24
<i>Conservation and Reclamation Plan</i> .....	24

## **1.0 INTRODUCTION**

### **1.1 The EIA Report**

The purpose of these Terms of Reference is to identify for the public and Imperial Oil Resources (IOR), the information required by federal and provincial government agencies for an Environmental Impact Assessment (EIA) report.

IOR will prepare and submit an EIA report to explain the environmental effects of its Kearl Oil Sands Project (the Project) and other existing and planned activities in the area related to the Project. The EIA report will be prepared in accordance with the requirements prescribed under the Alberta *Environmental Protection and Enhancement Act* (EPEA), and any other federal legislation, which may apply to the Project. It will form part of IOR's application to the Alberta Energy and Utilities Board (EUB) for approval under the *Oil Sands Conservation Act* (OSCA).

### **1.2 Public Consultation**

IOR's public consultation program will facilitate communication with members of the public and industry who may be affected, directly or indirectly, by the Project and will provide them with an opportunity to participate in the Environmental Assessment process. The EIA report will document the results of the public consultation program (see Section 10) and will provide environmental information to address the issues raised.

The consultation requirement for the EIA report does not give any party additional rights or status with the EUB or during the EPEA and *Water Act* (WA) approval processes. Status and rights in those approval processes are determined by the applicable governing legislation.

### **1.3 Proponent's Submission**

IOR is responsible for the preparation of the EIA report and related applications. The EIA report will be based upon these Terms of Reference and issues raised during the public consultation process. The EIA report will include a glossary of terms and a list of abbreviations to assist the reader in understanding the material presented. The EIA report will 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 WA.

## **2.0 Project Overview**

Provide a corporate profile clearly outlining the ownership structure of the corporation, an overview of the Project, the key environmental, resource management and economic issues that are important for a public interest decision, and the results of the Environmental Assessment. Identify those responsible for the development, management and operation of the Project. Provide a brief history of IOR's exploration in the oil sands area.

## **3.0 Regulatory and Planning Framework**

Identify the federal, provincial and municipal legislation, policies, approvals and current multi-stakeholder planning initiatives applicable to the review of this Project. List the major components of the Project that will be applied for and constructed under the EPEA, WA and the *Public Lands Act* (PLA).

Address other regulatory authorizations that exist or will be required for the Project under provincial, municipal and federal government requirements, and describe the schedule and mechanisms IOR will engage to comply with these regulatory processes.

Discuss the primary focus of each regulatory requirement, such as resource allocation, environmental protection, land use development and the elements of the Project that are subject to that regulation.

Discuss any regulatory systems that apply to the Project, such as solid waste or air pollution classifications, land use zones, wildlife management areas and forest management areas.

Provide a summary of the regional, provincial or national objectives, standards or guidelines that have been used in the classification and evaluation of the significance of effects.

### **3.1 EIA Summary**

Provide a summary of the results of the EIA report including:

- a) the project components and development activities which have the potential to affect the environment;
- b) existing conditions in the Study Area, including existing uses of lands, resources and other activities which have potential in combination with proposed development activities, to affect the environment;
- c) the environmental effects which are anticipated;
- d) proposed environmental protection plan(s), mitigation measures and monitoring; and
- e) residual effects.

Identify the environmental, cultural, and socio-economic impacts of the Project including the regional, temporal, and cumulative effects. Impact significance should be explained in terms of magnitude, extent, duration, frequency and reversibility. Where possible predictions are to be quantified.

Include suitable maps, charts and other illustrations to identify the components of the Project, the existing conditions, and the environmental and the socio-economic implications of the development.

Discuss the key environmental issues important for the achievement of sustainable environmental and resource management. Differentiate between emerging issues with uncertainties, issues with important environmental consequences and issues that can be mitigated through available technology and with existing management approaches. Describe how ongoing uncertainties and emerging issues will be addressed.

### **4.0 Project Description and Management Plans**

The scope and detail of the project description information shall be sufficient to allow quantitative assessment of the environmental consequences. If the scope of information varies among components or phases of the Project, IOR shall provide a rationale demonstrating that the information is sufficient for EIA purposes.

Describe the project components, infrastructure and activities. Discuss the alternatives considered, the alternative selection process, the potential effects that activities and infrastructures may have on

the environment and the natural resources to be used for the Project. Outline the management plans to minimize the discharge of pollutants, manage wastes, reclaim disturbed lands and waterbodies, optimize resource use, manage and monitor environmental effects.

Describe all of the activities and components of the Project that are proposed for approval. Provide outlines of the relevant management plans for these activities.

Technical information required in this Section may also be required for federal and provincial government approvals (see Appendix). Information required in this Section may be provided in other parts of IOR's submission(s) provided that the location of the information is appropriately referenced in the EIA report.

#### **4.1 Project Need and Alternatives Considered**

Discuss the need for oil sands development on the leases, the alternatives to the Project and the potential alternative of not proceeding with development. Include the following:

- a) an analysis of the key project alternatives that were considered, including project need, alternative projects, project scope (major components included or excluded) and alternative mining methods. Include a comparison of their environmental and technical performance potential and other relevant variables;
- b) provide the rationale for the decisions made by IOR about project alternatives and the status of any ongoing analyses, including a discussion of options not chosen and the rationale for their exclusion;
- c) contingency plans if major project components or methods prove to not be feasible or do not perform as expected;
- d) the implications of a delay in proceeding with the Project, or any phase of the Project; and
- e) potential cooperative development opportunities for the Project (e.g., shared infrastructure and the implications of the Project for ongoing regional management and research initiatives).

#### **4.2 Project Components and Site Selection**

Describe the nature, size, design capacity, location and duration of the components of the Project including, but not limited to, the following:

- a) the oil sands mine area required to support the life of the Project;
- b) the bitumen extraction, bitumen upgrading and associated facilities, tailings management, overburden storage areas and any chemical storage locations and any off-site facilities;
- c) dewatering and water control facilities, processing/treatment facilities and temporary structures;
- d) buildings and infrastructure, transportation, utilities, access routes, storage areas and mining operations;
- e) the type and amount of solid and liquid waste materials and the location of those waste storage and disposal sites;
- f) the location of components on a site development plan and the proposed phasing and sequencing of components and development phases. Include a development schedule, explaining:
  - i) timing of key construction, operational, reclamation and decommissioning activities;
  - ii) expected duration of each development phase for the life of the Project;
  - iii) key factors controlling the schedule and uncertainties related to the Project; and
- g) the total land area disturbed during each stage of the Project, a projection of the maximum amount of disturbance at any given moment, and a stewardship target that minimizes the amount of land area to be disturbed at any one time during project development;
- h) the environmental implications of alternative mining methods considered, including approaches to minimize the size and duration of disturbances;

- i) potential cooperative ventures with other oil sands operators and other resource users to minimize the environmental impact of the Project or the environmental impact of regional oil sands development. Discuss how IOR will work to develop such cooperative opportunities and identify a timeframe for their implementation to minimize the environmental impact of the Project. Identify environmental implications of lease boundary agreements with adjacent operators and indicate plans to address any lease boundary issues that may arise;
- j) the activities to date, but not limited to, resource delineation through seismic activity and core hole drilling programs; and
- k) how IOR has incorporated both community information and elements of Traditional Ecological Knowledge (TEK) into project design.

Discuss the site selection process for the various project components including:

- l) the process and factors that were considered in evaluating and delineating the oil sands ore body to determine the preferred locations for the mine, plant site and associated processing facilities and upgrader facility;
- m) siting factors with respect to existing activities or other resources and the need to either adjust the development or relocate the existing activity;
- n) the rationale for selecting the proposed sites and how stakeholder consultation input, and technical, geotechnical and environmental criteria were considered in decision-making, and the decision criteria used; and
- o) prepare a Constraints Map appropriate for a surface mining project (with reference to or consistent with the CEMA document “*Guidelines for the Implementation of Ecosystem Management Tools in the Athabasca Oil Sands Region*”) to identify constraints, including traditional land use areas, to the siting of surface facilities.

Include a discussion of the following:

- p) IOR’s efforts to use existing seismic lines and linear corridors and describe the types and spatial extent of any additional disturbance resulting from project development;
- q) planned accommodations for the workforce during construction and operations, including plans to minimize disturbance and provide for site reclamation after construction is complete; and
- r) how surface disturbance (extent and duration) will be minimized, including co-operation with other developments.

Provide the following maps showing:

- s) the location of existing and proposed project facilities and infrastructure;
- t) all existing surface leases and clearings and illustrate how these areas will be used for project development;
- u) all existing seismic lines and other linear corridors (e.g., pipeline, utility corridors and trap lines); and
- v) the locations of development components relative to all terrestrial components including, but not limited to, soils, topography, watercourses, waterbodies, vegetation, wildlife habitat, watersheds and wetlands.

#### **4.3 Process Selection and Description**

Provide material balances, flow diagrams and descriptions of the processes to be used for each production stage of development under normal operating conditions (annual average calendar day rates) and at maximum expected rates (stream day rates). Describe:

- a) oil sands mining and bitumen extraction, bitumen upgrading and associated facilities; and
- b) the alternative technologies considered.

Document and discuss the following:

- c) rationale for selection of the technologies chosen;
- d) the project inputs such as energy and water including the sources of these inputs, and the outputs such as emissions and chemical wastes; including the short- and long-term fate of these outputs (recycling, disposal), and efforts to minimize these inputs and outputs;
- e) the energy and process efficiency of the technologies chosen, including greenhouse gas emissions;
- f) the effect of technology selection on tailings characteristics including, but not limited to, quantity, quality, physical characteristics, generation and storage requirements, air and water discharges, toxicity, water and energy requirements, chemical and hydrocarbon waste streams, bitumen recovery and effects to reclamation programs; and
- g) opportunities to reduce surface disturbance, emissions, chemical and hydrocarbon wastes and energy consumption through structural and process integration of mining and extraction facilities and processes, or through other means.

#### **4.4 Materials Storage**

Identify the location and amount of all on-site and adjacent storage associated with bitumen production, including storage of chemicals, products, by-products, intermediates and associated wastes. Explain containment and environmental protection measures with reference to relevant provincial and federal guidelines.

#### **4.5 Utilities and Transportation**

Describe the project energy requirements, associated infrastructure and other infrastructure requirements. Discuss the following:

- a) the steps taken to integrate the needs of other resource users into the location and design of access infrastructure to reduce and manage overall environmental impacts from resource development;
- b) reducing or mitigating visual impact during construction and operation of infrastructure;
- c) how public access to, or within the Project Area or lease will be managed during the development phases of the Project;
- d) the impact of increased vehicle traffic on Highway 63 and roads in the oil sands development area, considering other existing and planned developments and operations in the region including what measures will be taken to reduce traffic and enhance vehicle safety on Highway 63;
- e) any expected change in traffic volume by Average Annual Daily Traffic (AADT) and any seasonal variability in traffic volume (include mitigation measures);
- f) consultations with the local transportation authorities;
- g) the sources, location and availability of road construction and reclamation materials, including an estimate of the volume of materials needed; and
- h) the options considered for supplying the power required for the Project and the environmental implications, including opportunities to increase the energy efficiency of the Project with the use of waste heat and electrical power.

Identify the potential energy source, product pipeline, electrical power transmission and access routes to the Project. If regional infrastructure is required, identify who will potentially be responsible for installation and approval of these facilities. Identify and locate all projected and related linear right-of-ways and any potential river and stream crossings and discuss the adequacy of their design with respect to spill prevention. Discuss contingency plans for spill response and any environmental risks associated with product releases or management practices.

#### **4.6 Water Supply, Water Management and Wastewater Management (see Appendix)**

Provide the following information for the Project:

- a) a water balance for each phase of the Project;
- b) process and potable water requirements for both normal and emergency operating situations and any seasonal or annual variability throughout the life of the Project (e.g., start-up, operation, closure and reclamation, end pit lake filling);
- c) how these requirements will be met, the various supply options considered (including on-site storage) and the rationale for choosing the preferred option. Reference as appropriate, technical information required in a WA application;
- d) the location of sources/intakes and associated infrastructure (e.g., pipelines for water supply);
- e) proposed well locations, aquifer intervals including completion depth and estimated quantities for groundwater withdrawal;
- f) raw water treatment requirements;
- g) measures for ensuring efficient use of water, including alternatives to reduce freshwater consumption such as water minimization, use of brackish water, recycling and other conservation techniques; and
- h) the impact of low flow conditions and instream flow needs (IFN) on water and wastewater management strategies including contingency plans for water sourcing or management alternatives to manage potential low flow withdrawal restrictions.

Provide a Water Management Plan, document and discuss the following:

- i) site runoff and containment, erosion control, groundwater protection, muskeg dewatering, mine pit dewatering and the discharge of aqueous contaminants;
- j) factors used in the design of water management facilities, including expected flood levels and flood protection; and
- k) permanent or temporary alterations or realignments to waterbodies and wetlands.

Provide a Wastewater Management Plan, describe and discuss:

- l) the source, quantity and composition of wastewater streams from each component of the proposed operations (e.g., oil sands mining, bitumen extraction, bitumen upgrading and associated facilities) for all project conditions, including normal, start-up, worst case and upset conditions;
- m) the design of facilities that will handle, treat and store wastewater streams and the type and quantity of any chemicals used in wastewater treatment, including measures taken in the design to prevent potential impacts to the environment;
- n) the options for wastewater treatment, including the rationale for selecting the preferred options, including a discussion of options not chosen and the rationale for their exclusion;
- o) the options for the disposal of wastewater (e.g., zero liquid discharge and injection wells), including the rationale for choosing the preferred options;
- p) the quantity, quality and timing of any proposed wastewater releases and their potential environmental effects;
- q) how produced water generation will be managed and how make-up water requirements and disposal volumes will be minimized;
- r) discharges to the surrounding watershed from existing and reclaimed sites, including the tailings management areas and the management strategy for handling such releases; and
- s) the potable water and sewage treatment systems for both the construction and operation stages.

#### **4.7 Air Emissions Management**

Identify and describe emissions for the Project, including point and area sources, fugitive emissions (including tailings management areas and mine faces), and emissions from mining vehicles.



Estimate the range of emissions from all sources for normal and upset conditions. Discuss the following from a management perspective:

- a) potential odorous or visual emissions;
- b) the amount and nature of any acidifying emissions, as well as, probable deposition areas and potential effects to soils, vegetation and waterbodies;
- c) emissions associated with slash burning;
- d) describe the expected annual and total greenhouse gas (GHG) emissions over the construction, operation and decommissioning phases of the Project;
- e) discuss the Project's marginal contribution to total provincial and national GHG emissions on an annual basis;
- f) describe the intensity of GHG emissions per unit of product produced and discuss how it compares with similar projects and technology performance;
- g) discuss how the project design and GHG management plans have taken into account the need for continuous improvement with respect to GHG emissions and their consistency with broader jurisdictional GHG management plans and objectives;
- h) discuss IOR's overall GHG management plans, any plans for the use of offsets, (nationally or internationally) and the expected results of implementing the plans;
- i) the emission control technologies proposed for the Project in the context of available practicable technologies. Discuss the following:
  - i) use of low oxides of nitrogen (NO<sub>x</sub>) technology for turbines and boilers having regard for 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*;
  - ii) fugitive emissions control program to detect, measure and control emissions and odours from equipment leaks having regard for the CCME *Code of Practice for Measurement and Control of Fugitive VOC Emissions*;
  - iii) use of technology to meet or do better than CCME *Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Aboveground Storage Tanks* and Alberta Environment *Guidelines for Secondary Containment for Aboveground Storage Tanks*;
  - iv) sulphur recovery or acid gas re-injection to reduce sulphur emissions having regard for current EUB sulphur recovery guidelines ID 2001-3;
  - v) emergency flaring scenarios and proposed measures to ensure flaring events are minimized having regard for EUB Guide 60 and design criteria to ensure that flares operate at high efficiency;
  - vi) gas collection, conservation and technology for vapour recovery for the Project's air emissions;
  - vii) technology or management programs to minimize the direct emission of particulate matter and trace metals of concern having regard to the provisions of the Canada Wide Standard for particulate matter and ozone; and
  - viii) monitoring programs IOR will implement to assess air quality and the effectiveness of mitigation during project development and operation. Discuss how these programs are compatible with regional multi-stakeholder air quality management initiatives and how IOR plans to incorporate air quality monitoring programs into the management of air emissions from their facility.

#### **4.8 Hydrocarbon, Chemical and Waste Management**

Characterize and estimate the volumes of hydrocarbon and chemical waste streams generated by the Project. Identify how each waste stream will be managed. Demonstrate that the selected options

for waste management are consistent with best industry practice. Provide the following information:

- a) a classification of the wastes generated and a characterization of each stream under the EPEA Waste Management Regulations;
- b) the location, nature and amount of on-site hydrocarbon storage. Discuss containment and other environmental protection measures;
- c) a listing of chemical product consumption for the Project. Identify products containing substances that are *Canadian Environmental Protection Act* (CEPA) toxic chemicals, on the Priority Substances List (PSL 2), on the National Pollutant Release Inventory (NPRI), or Track 1 substances targeted under Environment Canada's Toxic Substances Management Policy;
- d) in general terms, how chemical products will be stored and managed to ensure safety and environmental protection;
- e) the chemical make-up and quantity of drilling wastes produced by the Project;
- f) the management plan for exploratory drilling wastes, produced tailings, overburden and other mining wastes, as well as any by-products. Include evaluations to minimize fine fluid tailings production, considering mining methods and the proposed extraction process;
- g) the strategy for on-site waste disposal versus off-site waste disposal and an analysis of environmental implications of proposed options. Identify the location of on-site waste disposal locations, including industrial landfills. Identify on- and off-site waste treatment areas; and
- h) how, using specific examples, the principles of pollution prevention, waste minimization and recycling have been incorporated into the project design.

#### **4.9 Environmental Management System and Contingency Plans**

Summarize key elements of IOR's environment, health and safety management system and discuss how it will be integrated into the Project. Provide the following information:

- a) corporate policies and procedures, operator competency training, spill and air emission reporting and monitoring procedures and emergency response plans;
- b) plans to prevent or minimize the production or release into the environment of substances that may have an adverse effect;
- c) a conceptual contingency plan that considers environmental effects associated with operational upset conditions, such as serious malfunctions or accidents;
- d) the procedures specified in the emergency response plan to deal with potential negative impacts and public communication procedures;
- e) quality assurance and quality control (QA-QC) programs IOR plans to implement to ensure the ongoing operation of environmental management systems meet regulatory standards (such as the CCME leak detection and repair program) and how their QA-QC program compares to industry best management practices;
- f) environmental monitoring done independently by IOR in addition to monitoring performed in conjunction with other stakeholders and publicly-available monitoring information. Provide a comprehensive summary of all proposed monitoring, research and other strategies or plans to minimize, mitigate and manage any potential adverse effects; and
- g) describe new monitoring initiatives that may be required as a result of the Project and outline IOR's commitment to adaptive environmental management.

#### **4.10 Adaptation Planning**

Describe the flexibility built into the plant design and layout to accommodate future modifications required by any change in emission standards, limits and guidelines.

Comment on the adaptability of the Project in the event the region's climate changes significantly. Identify any implications that those possible climate changes might have for the sustainability of the Project. Discuss any follow-up programs and adaptive management considerations.

#### 4.11 Reclamation and Closure (see Appendix)

Provide a conceptual, comprehensive, progressive reclamation and closure plan for the Project (with regard to the selected tailings technology). Outline reclamation concepts and objectives, proposed end land use objectives and consultation process and other factors necessary for this plan to be implemented. Discuss the following:

- a) the present uncertainties regarding mine reclamation techniques, the efforts to reduce the uncertainties, including contingency plans;
- b) consideration of baseline information with respect to capability for vegetation, forest productivity, recreation, wildlife, birds, fisheries, aesthetics and land use resources;
- c) reclamation sequencing for each phase of development;
- d) re-establishment of topography, watercourse and vegetation communities of natural function and appearance that are integrated with the surrounding landscape and adjacent land disturbances. Include in the discussion out-of-pit structure design, riparian areas and other developments; and the return to equivalent land capability that existed prior to the project development, including forest productivity and wildlife habitat;
- e) document the return of land capability through the application of management strategies for reclamation. Discuss instances where capability cannot be achieved such as what existed prior to project development;
- f) reforestation plans to the ecosite phase levels to achieve land use capabilities equivalent to those that existed prior to the project development;
- g) a conceptual schedule for the return of the forest resource base, by area, species and productivity;
- h) restoration of traditional land-based uses;
- i) soil replacement and revegetation; and
- j) end pit lakes, wetlands and other components of the reclaimed landscape.

Discuss the timeframe for completion of reclamation phases and release of all lands affected by the Project back to the Crown, including previously-disturbed lands and public access.

Discuss how the IOR closure plan will:

- k) return land to the equivalent capability for the range of users and uses that existed prior to the project development having regard for regulatory requirements and stakeholder end land use preferences. Describe what reclamation performance indicators will be used to ensure this requirement will be met;
- l) incorporate the resources and values identified in the *Fort McMurray/Athabasca Oil Sands Sub-regional Integrated Resource Plan (IRP)* into the closure plan; and
- m) address the issues raised by the Cumulative Environmental Management Association (CEMA) and the Regional Sustainable Development Strategy for the Athabasca Oil Sands (RSDS).

Describe how the closure plan will achieve the desired final landforms through the integration of mine planning and development and reclamation and goals within the IRP for reclamation to natural landforms.

Describe the aquatic components of the closure landscape, including end pit lakes. Discuss issues related to the design of a self-sustaining and productive aquatic ecosystem, including implications of the selected tailings technology. Explain process and activities IOR will undertake to address issues of uncertainty surrounding the long-term ecological viability of end pit lakes. Include a hydrological analysis of the closure landscape, including an assessment of performance uncertainties and discussion of contingency plans should performance not match expectations. Contrast the pre-development aquatic ecosystem to the closure ecosystem.

Describe how the closure plan incorporates topographical diversity, size and extent of vegetation and wetlands into the final design. Identify the closure plan goals for biodiversity. Explain how achieving biodiversity goals will promote end land use that has equivalent land capability. Discuss the compatibility of these two goals.

Discuss plans to monitor biodiversity in the reclaimed landscape, considering the use of control sites as benchmarks for comparison with reclaimed areas, and using Alberta Biodiversity Monitoring Program protocols. Using the biotic and abiotic pre-disturbance assessment factors, compare pre-disturbance to post-disturbance biodiversity.

#### **4.12 Participation in Regional Cooperative Efforts**

Discuss IOR's current and planned participation in regional cooperative efforts to address environmental health and socio-economic issues associated with regional development including, but not limited to, CEMA, the Wood Buffalo Environmental Association (WBEA) and the Regional Aquatics Monitoring Program (RAMP) and their working groups. Include IOR's participation in regional air, water and other environmental monitoring programs, health studies, research, TEK and socio-economic studies.

Describe where IOR intends to rely upon CEMA, WBEA, RAMP, and Canadian Oil Sands Network for Research and Development (CONRAD) to design mitigation measures for cumulative effects, regional monitoring programs or research programs.

Describe how IOR will contribute to the effective design and implementation of proposed mitigation measures, monitoring programs and research programs within these regional cooperative efforts.

### **5.0 Environmental Assessment**

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. "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 sooner.

#### **5.1 Basic Information Requirements for the Environmental Assessment**

The EIA report will include the following basic environmental information requirements for the three assessment scenarios:

- a) quantitative and qualitative information about the environment and ecological processes in the Study Areas, including TEK and relevant information presented in previous environmental assessments and an overview of trends or uncertainties arising from that review;
- b) a description of any deficiencies or limitations in the existing environmental database, how these deficiencies and/or limitations were addressed, their impact on the analysis and any appropriate follow-up;

- c) discussion of the reliability of data, including synthetic data, used in the EIA, including any modelling exercises. Include a discussion on the potential range of model results based on variability of the data used. Describe plans for ongoing model parameter updates and model validation;
- d) information about the human activities in the Study Areas and the nature, size, location and duration of their potential interactions with the environment; e.g., land disturbance, discharges of substances, changes to access status and any significant effect the Project may have on the present and future capacity of renewable resources;
- e) information about ecological processes and natural forces that are expected to produce changes in environmental conditions; e.g., forest fires, flood or drought conditions and predator-prey population cycles;
- f) the demonstrated use of appropriate predictive tools and methods, consistent with CEMA, WBEA and RAMP and any other relevant initiatives, to enable quantitative estimates of future conditions with the highest possible degree of certainty;
- g) definition of the system employed to classify and evaluate the effects associated with the Project. The classification system will include qualitative and quantitative descriptions of the effects, having regard for direction, magnitude, geographic extent, duration, reversibility and frequency (CEAA Responsible Authority's Guide). The evaluation system will rank the consequences of the effects measured quantitatively against management objectives or baseline conditions, and described qualitatively with respect to the views of the proponent and stakeholders;
- h) management plans to prevent, minimize or mitigate adverse effects and to monitor and respond to expected or unanticipated conditions, including any follow-up plans to verify the accuracy of predictions or determine the effectiveness of mitigation plans. Provide a record of all assumptions, confidence in data to support conclusions regarding reclamation and mitigation success;
- i) a discussion of residual effects and their environmental consequences, having regard for regional management initiatives;
- j) identify all stages or elements of the Project that are sensitive to changes or variability in climate parameters. Include, but not necessarily limit parameters to, temperature, precipitation and wind;
- k) for those elements of the Project that are sensitive to climate parameters discuss changes in those parameters over the life of the Project (including decommissioning and reclamation) and the level of confidence associated with those changes. Discuss what impacts the changes to climate parameters may have on elements of the Project that are sensitive to climate parameters;
- l) discuss what impacts of the Project, including environmental, human health and cumulative impacts may be altered by changes in climate parameters;
- m) document any assumptions or transformations required to combine or manipulate data for interpretations in the EIA report. Describe rationale for disregarding relevant data;
- n) identify assumptions behind statistical tests used in the EIA report and show that the data meets statistical requirements (e.g., normality, independence, etc.); and
- o) for each model used to predict future conditions, provide:
  - i) a pictorial representation for all model compartments and linkages including all subroutines and modules;
  - ii) a list of all parameters incorporated in the model [(reference to pictorial representation in m)] above with a brief description of their purpose, known range of values, whether set from literature, calibrated, or measured (derived from local data) and the value(s) used in the EIA predictions;
  - iii) a sensitivity analysis demonstrating which parameters have the largest influence on model output; and

- iv) a discussion of error for the parameters to which the model is most sensitive and for the final model output.

## 5.2 Study Areas

Define and provide the rationale for the spatial and temporal boundaries for the Study Areas used for the assessment. The spatial boundaries shall include all areas where measurable changes in the environment may be caused by the Project regardless of any political boundaries. The boundaries should take into consideration relevant CEMA, WBEA and RAMP initiatives. Temporal boundaries should extend through the exploration, construction, operation and reclamation and closure phases of the Project. Provide resource maps of suitable scale that include legal land descriptions, topographical and other natural features of the Project Area and EIA Study Areas.

## 5.3 Cumulative Environmental Effects Assessment

Assess and discuss the cumulative environmental effects that are likely to result from the Project in combination with other existing, approved and planned projects in the region that could reasonably be considered to have a combined effect. Include industrial projects, as well as activities associated with land use and infrastructure.

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. Provide a record of all assumptions, confidence in data and analysis to support conclusions. Describe deficiencies or limitations in the existing database on environmental components and propose measures to deal with resultant uncertainties.

## 5.4 Climate, Air Quality and Noise

Describe air quality in the Study Areas and any anticipated environmental changes for air quality. Review emission sources identified in Section 4.7 and model normal, worst case and upset conditions. Discuss the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) baseline climatic conditions, including the type and frequency of meteorological conditions, that may result in poor air quality;
- c) fate and effects of appropriate air quality parameters including, but not limited to, sulphur dioxide (SO<sub>2</sub>), hydrogen sulphide (H<sub>2</sub>S), Total Reduced Sulphur Compounds (TRS), total hydrocarbons (THC), NO<sub>x</sub>, volatile organic compounds (VOC), individual hydrocarbons of concern in the THC and VOC mixtures, particulates (PM<sub>10</sub> and PM<sub>2.5</sub>), secondary particulate matter, trace metals, acid deposition and ground-level ozone;
- d) estimates of ground-level concentrations of the appropriate air quality parameters, include frequency distributions for air quality predictions in communities and sensitive receptors; and include an indication of maximum and 99.9 percentile (98 percentile for any modelling predictions);
- e) any expected changes to particulate deposition or acidic deposition patterns;
- f) justification of models used, model assumptions, and any model shortcomings or constraints on findings. Discuss the meteorological data model input set used to run the model and provide a rationale for the choice of data set;
- g) the modelling in accordance with Alberta Environment's *Air Quality Modelling Guidelines*;
- h) for acid deposition modelling, provide deposition data from maximum levels to areas within the 0.25 keq/ha/yr and 0.17/keq/ha/yr Potential Acid Input (PAI) isopleth; include analysis of PAI deposition levels consistent with the CEMA acid deposition management framework;

- i) the regional, provincial and national objectives for air quality that were used to evaluate the significance of emission levels and ground-level concentrations, including the Canada Wide Standard for particulate matter and ozone;
- j) predicted air quality concentrations compared with the appropriate air quality guidelines available;
- k) any implications of the expected air quality for environmental protection and public health including:
  - i) sensitive receptors in the receiving environment which are likely to be exposed to air quality and deposition changes;
  - ii) the likely exposure levels, either acute or chronic, experienced by the receptors, their effects on the receptors and the ability of the receptors to recover from those effects;
  - iii) the potential for decreased air quality, including odours; and
  - iv) the implications for sustaining regional air quality within emerging regional air quality objectives;
- l) air quality impacts resulting from the Project and their implications for other environmental resources including, but not limited to, habitat diversity and quantity, vegetation resources, water quality and soil conservation;
- m) how air quality impacts resulting from the Project will be mitigated;
- n) ambient air quality monitoring that will be conducted;
- o) baseline noise levels. Identify components of the Project that will affect noise levels; and
- p) the results of a noise assessment based on operations, as specified by EUB ID 99-08, Noise Control Directive, including potentially-affected people and wildlife. Provide an estimate of the noise resulting from the development, their implications and proposed mitigation measures.

## **5.5 Land Use, Access to Public Lands and Aggregate Resource Conservation**

Describe land use, access to public lands and the availability of aggregate resources in the Study Areas. Explain the significance of land use changes for regional land management, aggregate resource conservation, other industrial uses in the region, the maintenance of traditional lifestyles, and recreational uses. Provide information on land uses and seasonal variations. Discuss the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) unique sites or special features in the Study Areas, such as Natural Areas or Environmentally Significant Areas. Discuss any impacts of the Project on these features. Indicate the location and values of Wildland Parks, if present;
- c) the existing land uses, including the metallic and industrial minerals development, oil sands development, tourism, forestry, fishing, hunting, cultural and traditional use and outdoor recreation;
- d) the nature, location and duration of anticipated land use changes;
- e) the land use, resource management, planning and applicable directives as they relate to the Project;
- f) whether and to what extent, the development is consistent with the intent of the applicable land use and resource management and planning directives. Identify:
  - i) the relevant boundaries for the application of guidelines and objectives, including management areas, sub-areas and relevant ecosystem classifications with functional linkages mapping;
  - ii) mitigation or research requirements proposed to satisfy the applicable guidelines; and
  - iii) the proposed setbacks from waterbodies and watercourses with regard for applicable guidelines and management objectives. Discuss the rationale for the location of proposed facilities in the context of the proposed setbacks;

- g) the existing recreational use including traffic counts, destination and activity analysis and the implications of the Project on those activities in all seasons, during and after, development activities;
- h) the aggregate resources impacted by the mine development. Discuss the quantity and quality of aggregate resources and any mitigation necessary to conserve the resource;
- i) the process for addressing other users such as trappers and holders of Forest Management Agreements (FMA) and Timber Quota holders. Determine the impact of development on these uses and identify possible mitigation strategies;
- j) the use of the fish resources by existing and potential domestic, traditional and sport fisheries; and
- k) how reclamation and closure planning processes, completed or underway, will replace existing land use potential considering the recommendations of applicable guidelines.

## **5.6 Terrestrial and Aquatic Ecosystems**

Describe ecosystem characteristics in the Study Areas. Explain the significance of any anticipated environmental changes for ecosystem integrity. Include the sustainability of biodiversity, critical wildlife sites and fisheries habitat, wildlife corridors, habitat quality, and productivity and potential changes to fish and wildlife populations. Discuss the existing use of plants and animals in traditional lifestyles, recreational pursuits and industrial activities and, if appropriate, provide the locations of these sites.

### **5.6.1 Biodiversity**

Determine a suite of biotic and abiotic biodiversity indicators for terrestrial and aquatic ecosystems that characterize naturally-functioning ecosystems in the Study Areas and represent broader taxonomic assemblages. In addition:

- a) discuss the selection process and rationale used to select biotic and abiotic biodiversity indicators;
- b) within selected taxonomic groups, discuss the regional presence and abundance of species in each ecosite phase or ecological type;
- c) provide species lists and summaries of observed and estimated species richness and evenness. Baseline information collected in each terrestrial and aquatic vegetation community will be accompanied by sufficient plots in each ecosite phase to provide reliable data using a suitable proportional sampling method and to provide a measure of biodiversity on baseline sites that are representative of the proposed reclamation ecosites;
- d) rank each ecological unit for biodiversity potential by combining measures of species richness, overlap in species lists, importance of individual species or associations, uniqueness and other appropriate measures. Describe the techniques used in the ranking process;
- e) discuss the contribution of the Project to any anticipated changes in regional biodiversity, including measures to minimize such change;
- f) discuss the implications of the Project's incremental contribution to habitat fragmentation on biodiversity with regard to regional levels of habitat fragmentation;
- g) identify and describe IOR's participation in regional biodiversity programs (e.g., Alberta Biodiversity Monitoring Program) to monitor and track changes to biodiversity on lease areas, and to measure cumulative effects in the region;
- h) discuss pre- and post-topography, soil and parent material conditions and their contribution to biodiversity; and
- i) discuss terrestrial and aquatic ecosystem diversity.

### **5.6.2 Geology, Soils, Terrain**

Describe the bedrock and surficial geology, soils and terrain in the Study Areas. Where appropriate, use maps of suitable scale, cross-sections and figures to illustrate these features.



Explain the significance of any changes for the regional landscape, biodiversity, productivity, ecological integrity, aesthetics and the future use of the regional landscape area. Discuss the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) the overburden geology and mineralogy;
- c) the distribution of soil types in the proposed project areas using appropriate soil survey procedures as outlined in the Soil Survey Handbook, Vol. 1 (Agriculture Canada, 1987);
- d) the soil survey maps should show approximate soil inspection and sampling locations corresponding to appropriate survey intensities in the footprint areas. The soil survey report should include necessary landscape and soil characteristics for land capability rating;
- e) the sensitivity and buffering capacity of the local and regional soil types to potential acid deposition from the proposed development and the predicted deposition patterns;
- f) the predicted acidifying impact to local and regional soils resulting from the Project with reference to local studies, current guidelines and management objectives for acidifying emissions consistent with the CEMA acid deposition management framework;
- g) the implications of environmental effects on ecosystem sustainability and regional management, including:
  - i) any constraints or limitations to achieving vegetation restoration based on anticipated soil conditions;
  - ii) an assessment of soil types for reclamation suitability and the approximate volume of suitable soil materials for reclamation;
  - iii) the potential for soil erosion and measures to minimize the effects of any such erosion; and
  - iv) any other issues that will affect the soil capability of the Study Areas or the reclaimed landscape and the mitigation measures proposed;
- h) an estimate of the effects of surface disturbance on geological features and soils, including:
  - i) the type and extent of changes to the pre-disturbance topography;
  - ii) the overburden characteristics in relation to the needs of post-mining reclamation programs; and
  - iii) an assessment and maps of the pre- and post-disturbance land capability and resiliency of the Project Area and a description of the impacts to land capability resulting from the Project.

### **5.6.3 Vegetation**

Describe and map vegetation communities in the EIA Study Areas, using, as appropriate, the Alberta Vegetation Inventory (AVI) Standard AVI 2.1, *The Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald, 1996) and the Alberta Wetland Inventory Standards Manual (AWI) Version 1.0. Map the project development footprint at a scale of 1:20,000. Discuss the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) ecosite phases based on their potential to support rare plant species, old growth forests or other communities of restricted distribution, e.g., fens. Verify the presence of species of rare plants and the ecosites in which they are found using recommended survey methods;
- c) the species associated with each ecosite phase and address:
  - i) special status plant species (rare, threatened or endangered);
  - ii) species which are important to wildlife as food or shelter or are indicator species for environmental effects. Include an estimation of the relative abundance of these species;
  - iii) the importance of the size, distribution and variety of vegetation units assessed in habitat suitability indices for wildlife and riparian habitat and for ecosystem function, in general;

- iv) the importance of peatlands and wetlands species and landscape units for local and regional habitat, sustained forest growth, the hydrologic regime and water quality. Determine the rarity or abundance of peatlands and wetlands from a regional, provincial and national perspective; and
- v) the vegetation used for food, medicinal and cultural purposes;
- d) the sensitivity to disturbance of each of the vegetation communities and their ability to be restored, as well as the techniques used to estimate sensitivity to disturbance and reclamation (e.g., sensitivity to air emissions), particularly for those communities for which a high degree of uncertainty currently exists around potential and methods for successful reclamation;
- e) the nature, size, distribution and timing of changes to vegetation communities, including the effects of air emissions;
- f) the significance of the changes to vegetation for:
  - i) the availability of plants for traditional and medicinal purposes;
  - ii) the sustainability of peatlands and wetlands in conjunction with other project-induced variations in air quality, hydrology, water quality and quantity, habitat quality and wildlife populations;
  - iii) the area of productive and non-productive forest land base that will be disturbed and taken out of production during the life of the Project. Discuss by species and productivity, ecosite phase and age class and include any other information needed to amend the appropriate FMA. Describe IOR's plans for the return of pre-disturbance forest ecosites by area, species and productivity;
  - iv) ecosystem fragmentation;
  - v) introduction of non-native plant species on native species composition and potential plant changes to communities;
  - vi) the area and distribution of all vegetation communities existing prior to the project development and expected at closure, including relative percent change in those communities; and
  - vii) habitat diversity and quantity, water quality, erosion potential, soil conservation, recreation and other uses, both at baseline and closure;
- g) IOR's plans to mitigate the adverse effects of site clearing and other development activities and operations on vegetation, including rare plant species; and
- h) discuss how environmental plans for the Project will address applicable provincial and federal policies for wetlands.

#### **5.6.4 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. Discuss the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) the criteria and selection process for wildlife indicator species;
- c) wildlife species composition, distribution, relative abundance, key habitat areas, seasonal movements and movement corridors, and general life history requirements; and
- d) current field data, using recognized sampling protocols, for all species of concern, including those listed by Alberta (at risk, may be at risk, and sensitive list species in the *General Status of Alberta Wild Species 2000*, or update) and federal *Species at Risk Act* (endangered, threatened, and special concern species).

Provide an impact assessment for wildlife indicators and listed wildlife species in the Study Area including:

- e) potential adverse impacts on wildlife populations, habitat use, availability and quality, and food supply during all phases of the Project. Model habitat supply over time within the Study Areas for the selected indicator species, population viability analysis may be necessary for some key species. Habitat models used to evaluate impacts should be modified/calibrated by comparing model predictions with wildlife data from the Study Areas;
- f) habitat loss, abandonment, reduced effectiveness, fragmentation or alteration as it relates to reduced reproductive potential and recruitment for regional wildlife populations over the life of the Project and time required to recolonize;
- g) the spatial and temporal changes to habitat (type, quality, quantity, diversity and distribution) and to wildlife indicator species 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; and
  - 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, noise effects and hunting pressure) during operations and after project closure; and
- h) map the changes in habitat fragmentation, and the potential for habitat patch isolation, anticipated from the Project and other planned activities on a local and regional level; and
- i) how IOR will ensure the protection and maintenance of riparian habitats, interconnectivity of such habitat and the unimpeded movement by wildlife species using the habitat.

Provide the following information:

- j) identify residual impacts to wildlife and wildlife habitat and discuss their significance in the context of local and regional wildlife populations; and
- k) a strategy and mitigation plan to minimize impacts on habitat and wildlife populations through the life of the Project and to return productive wildlife habitat to the area, considering:
  - i) habitat enhancement measures in adjacent undisturbed lands within the leases, 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;
  - iv) monitoring programs to assess wildlife impacts from the Project and the effectiveness of mitigation strategies and habitat enhancement measures;
  - v) environmental management procedures that IOR will use should monitoring indicate that mitigation measures are unsuccessful;
  - vi) the deterrent systems that will be incorporated into the Project to reduce the impacts on birds and other wildlife attracted to open ponds or wastewater ponds; and
  - vii) an assessment of the timeframe required to develop habitat of suitable quality and quantity on reclaimed lands, and the effects on re-colonization for each species identified.

#### **5.6.5 Groundwater (see Appendix)**

Describe baseline groundwater conditions and map the groundwater regime in the Study Areas.

Discuss the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) any new hydrogeological investigations, including methodology and results;

- c) justification of hydrogeological models used for the assessment, including sensitivity analysis and any model shortcomings or constraints on findings and how any limitations were addressed;
- d) the suitability of on-site waste disposal and supporting geotechnical information;
- e) the potential for hydraulic connection between geological zones affected by the Project (e.g., disposal, bitumen production, groundwater production and the land surface);
- f) surrogate parameters to be used as indicators of potential aquifer contamination including, but not limited to, total phenols, dissolved organic carbon, total extractable hydrocarbons, chlorides, sulphides, benzene, toluene, ethylbenzene and xylenes (BTEX) and trace elements, including arsenic;
- g) the potential for changes in the groundwater regime and the effects of these changes, including:
  - i) potential or expected changes in groundwater quality for any aquifer resulting from project operations;
  - ii) the effects from the Project and cumulative effects on local and regional groundwater regimes, including vertical gradients and aquifer recharge rates and changes resulting from any proposed diversions;
  - iii) an inventory of all groundwater users. Identify water use conflicts and proposed resolutions;
  - iv) the potential impact of decreased recharge to aquifers under prolonged drought conditions and the potential impacts of groundwater withdrawal due to project activities under drought conditions;
  - v) the effect of groundwater withdrawal/dewatering and its implications for other environmental resources, including habitat diversity and quantity, surface water quality and quantity, vegetation, wetlands and soil saturation;
  - vi) a numerical model to obtain a long-term prediction of the effects due to groundwater withdrawal/dewatering; discuss model validation. Provide details (e.g., location, completion) on any observation well network used to calibrate the model;
  - vii) the inter-relationship of the groundwater to the surface water and the potential for impacts on water quality and quantity due to recharge from and discharge to local waterbodies and wetlands; and
  - viii) the probability of re-injecting mine depressurization water from the aquifer beneath the bituminous sands, the target aquifer segment, its location and capacity to absorb and release injected water, and the chemical compatibility of the injection and formation water; the potential for contaminant migration in groundwater from and its impact on receiving surface waters; and
- h) a conceptual plan and implementation program for the protection of groundwater resources, including the following:
  - i) the early detection of potential contamination and remediation planning;
  - ii) groundwater remediation options in the event that adverse effects are detected; and
  - iii) monitoring the sustainability of groundwater production or dewatering effects.

Provide the following information:

- i) major aquifers, aquitards and aquicludes, and groundwater flow direction and velocity. Include Quaternary deposits and bedrock formations down to the Devonian including the bitumen-producing zones and any disposal zones;
- j) the lithology, stratigraphic and structural continuity, thickness, hydraulic properties and groundwater quality of the geologic units in the Study Areas;
- k) maps and cross-sections that include groundwater table and piezometric surfaces based on identifiable groundwater systems and accurate data sources, such as drill holes; and

- l) potential aquifers for any deep disposal of wastewater. Characterize any formations chosen for deep well disposal, including water quality, chemical compatibility and containment potential within the disposal zone.

#### 5.6.6 *Surface Water*

Discuss baseline hydrological conditions in the Study Areas. Describe the regional hydrology of the Muskeg River basin prior to oil sands mining in the basin. Identify project activities that may affect surface water during all stages of the Project, including site preparation, construction, operation, reclamation and decommissioning. Provide an inventory of all surface water users in the Study Areas. Discuss the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) the impacts of water withdrawals. Include cumulative effects and consider emergency operating, low-flow conditions and in-stream flow needs;
- c) the effect on vegetation, wildlife, fish and fish habitat of withdrawing water from any potential surface water source to meet the requirements for the Project during a range of seasonal flow regimes;
- d) the potential impact of any alteration in flows, including all temporary and permanent stream realignments or other disturbances, their extent and duration; discuss proposed mitigation measures;
- e) buffers for streams and waterbodies in the Local Study Area and their rationale;
- f) the pre- and post-disturbance alignment and condition of all ephemeral and permanent streams and waterbodies, including those created by the Project. Consider:
  - i) the 1:100 year flood level; including the potential for flooding during heavy precipitation events and spring runoff. Address the effects of probable maximum flood and precipitation events on ponds, containment structures and infrastructure; and
  - ii) other activities in the watersheds affected by the Project that, together with the proposed development, have potential to influence water quantity (e.g., existing and approved oil sands activities, commercial timber harvesting programs); and
- g) IOR's planned mitigation to prevent or minimize potential impacts, addressing:
  - i) how permanent stream realignments and other disturbances can enhance existing or rebuilt streams to increase habitat productivity for aquatic resources and recreation potential;
  - ii) measures to reduce impacts to waterbodies and wetlands;
  - iii) regional initiatives such as the CEMA Surface Water Working Group; and
  - iv) a monitoring program to identify hydrological impacts and to assess performance of water management systems and predictive modelling in the Local Study Area.

Describe the existing and anticipated water quality of waterbodies. Discuss the following:

- h) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- i) baseline water quality data, its seasonal variation and relationship to flow and other controlling factors. Consider appropriate water quality parameters; e.g., temperature, pH, conductivity, cations and anions, metals, dissolved oxygen, suspended sediment, dissolved solids, nutrients and other oil sands water contaminants, such as naphthenic acids;
- j) describe baseline sediment quality including, but not limited to, particle size, carbon content, organics, metals, sediment toxicity, and oil sands sediment contaminants, such as PAHs;
- k) project activities that may influence water quality. Place them in context with natural forces that affect water quality and how, where and when they will act to change water quality;
- l) calculate probability distributions for concentrations in any surface water receiving site drainage, discharges, or groundwater influenced by proposed activities;

- m) water quality conditions in reclaimed waterbodies and any other waterbodies potentially affected by the Project. Include:
  - i) the impacts on sediments and compare data with the *Canadian Interim Sediment Quality Guidelines*;
  - ii) the potential effects of project and cumulative acidic deposition on water quality, aquatic biota and habitat conditions of surface waterbodies consistent with the CEMA acid deposition management framework. Identify waterbodies that are sensitive to acid deposition;
  - iii) the potential for seasonal variations in acid input to waterbodies (spring acid pulse);
  - iv) any water quality implications of the tailings deposits, including the amount and quality of water or leachate released, their permeability and groundwater characteristics;
  - v) any other activities in the watersheds affected by the Project that, together with the proposed development, have potential to influence water quality (e.g., existing and approved oil sands activities and commercial timber harvesting programs). Discuss the potential changes in water quality anticipated from these other activities during the life of the proposed development. Consider their magnitude, extent, timing, duration and significance; and
  - vi) water quality of the reclaimed site;
- n) a comparison of existing and predicted water quality, using as appropriate, the *Surface Water Quality Guidelines for Use in Alberta*, the *Canadian Water Quality Guidelines* and relevant United States Environmental Protection Agency Guidelines. Consider the recommended procedures described in the document entitled: "*Protocol to Develop Alberta Water Quality Guidelines for Protection of Freshwater Aquatic Life*";
- o) proposed mitigation plans;
- p) the residual effects for each stage of the Project, including post-reclamation. Predict and describe water and sediment quality conditions and suitability for aquatic biota in constructed waterbodies, such as end pit lakes; and
- q) proposed water quality and sediment quality monitoring programs for metals and other relevant substances; e.g., polycyclic aromatic hydrocarbons (PAHs). Consider seasonality, sampling medium (water, sediment, biota) and other factors such as, waterbodies sampled, sample sites, precipitation and runoff levels, downstream and point-source discharges.

### 5.6.7 *Aquatic Resources*

Describe existing aquatic resources, e.g., fish and benthic invertebrates, their use and potential use of associated habitats in watercourses, wetlands and other waterbodies in the Study Areas.

Document the anticipated changes to aquatic resources in the Study Areas. Discuss the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) current field data, using recognized sampling protocols, for all sensitive species, including those listed by Alberta Environment (at risk, may be at risk, and sensitive list species in the *General Status of Alberta Wild Species 2000*, or update) and federal *Species at Risk Act* (endangered, threatened, and special concern species);
- c) historical and current studies on fish and other aquatic resources in the Local Study Area;
- d) the criteria and selection process for key indicator species;
- e) the life stages and requirements for key species and what, if any, effects the Project will have on them;
- f) the aquatic biological resources in waterbodies affected by the Project, including composition, distribution, relative abundance, critical or sensitive seasonal habitat use and movement patterns;

- g) the implications of any construction, operation and reclamation activities in the Study Areas for aquatic biological resources and habitat. Clarify how stream alterations, changes to substrate conditions, stream flow conditions and water quality may affect these resources and habitat;
- h) the nature of the potential effects, their duration; whether they are site-specific, local or regional in spatial extent; and the mitigation measures and habitat enhancement techniques that will be implemented to prevent or minimize any anticipated adverse effects. Discuss:
  - i) the potential for tainting of flesh, survival of eggs and fry, chronic or acute health effects, changes in the invertebrate community and food base; and increased stress on fish populations from release of contaminants, sedimentation, flow variations and habitat changes;
  - ii) potential impacts on riparian areas in the Local Study Area that could impact aquatic biological resources and productivity; and
  - iii) potential for increased fishing pressure and the potential impacts that could result from increased use of the area and increased access in the area;
- i) the implications of potential effects on fish productivity and the need for access controls or other management strategies to protect the resources. Discuss plans to offset any incremental loss in the productivity. Indicate how environmental protection and compensation plans for the Project will address applicable provincial and federal policies for fish habitat, including the 'No Net Loss Guiding Principle';
- j) programs to monitor aquatic habitat quality and the effectiveness of mitigation strategies;
- k) environmental management procedures should monitoring indicate that mitigation strategies are not effective;
- l) how increased habitat productivity for aquatic resources can be incorporated into permanent stream realignments and any other associated developments;
- m) any monitoring programs that have been, or will be, conducted in cooperation with other oil sands operators or multi-stakeholder initiatives to identify and manage effects from the Project and to confirm the effectiveness of mitigation strategies employed; and
- n) residual impacts on aquatic resources and their significance in the context of local and regional aquatic resources, including fisheries.

## **6.0 Environmental Monitoring**

Describe monitoring activities that IOR will undertake to verify and manage environmental impacts, confirm performance of mitigative measures and improve environmental protection strategies to further the understanding of the Project's impact on the environment. Discuss the following:

- a) all monitoring activities and initiatives that IOR is proposing to conduct independently of other stakeholder activities in the region, including a discussion of how such monitoring activities are compatible with regional monitoring initiatives;
- b) all monitoring activities that IOR is proposing to conduct collaboratively with other stakeholders. Include the role that IOR anticipates taking in each of the programs;
- c) any monitoring activities that may be conducted outside Alberta to confirm that the Project does not impact directly or indirectly on sensitive receptors outside of Alberta; and
- d) mechanisms for sharing results, reviewing findings and adjusting programs should monitoring identify unanticipated consequences of IOR's operations or mitigation plans, including:
  - i) corporate adaptive management strategies;
  - ii) steps that IOR will take to involve regulators and public stakeholders; and
  - iii) steps to communicate unanticipated conditions to regulators and regional management forums if regional environmental conditions may be affected.

## **7.0 Public Health and Safety**

Describe those aspects of the Project that may have implications for public health including the delivery of regional health services. Determine whether there may be implications for public health arising from the Project. Discuss the following:

- a) the data and methods IOR used to assess impacts of the Project on human health and safety;
- b) 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 or chronic adverse effects on human health;
- c) cumulative health effects that are likely to result from the Project in combination with other existing, approved and planned projects;
- d) the potential for contamination of fish by wastewater discharges relative to fish consumption guidelines;
- e) the potential for changes to air, water and soil quality and the bio-accumulation of contaminants in natural food sources to increase human exposure to contaminants;
- f) 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;
- g) potential health and safety impacts due to higher regional traffic volumes, such as accident rates and severity, and the increased risk of accidental leaks and spills;
- h) impacts of the proposed Project on potential shortages of affordable housing and the quality of health care services. Identify and discuss the mitigation plans to address these issues. Provide a summary of any discussions that have taken place with the Municipality and the Regional Health Authority concerning potential housing shortages and health care services respectively; and
- i) health and safety concerns raised by stakeholders during consultation on the Project.

Provide the following information:

- j) existing agreements with area municipalities or industry groups such as safety co-operatives, emergency response associations and municipal emergency response agencies;
- k) information on samples of selected species of vegetation known to be consumed by humans;
- l) a summary of IOR's emergency response plan and mitigation plans to ensure workforce and public safety during 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; and
- m) how local residents will be contacted during an emergency and the type of information that will be communicated to them.

## **8.0 Historical Resources and Traditional Land Use**

Provide a general overview of the results of the Historical Resources Impact Assessment (HRIA) of the Project, including any previous heritage resource studies that have been conducted in the Study Area. Provide an outline of the historical resources program and schedule of field investigations that may be required to assess and mitigate the effects of the Project on historical resources.

Provide details of IOR's consultation with Aboriginal groups to determine the effects of traditional use of the Local Study Areas. Document any stakeholder concerns regarding the impact of the Project on the historical significance of the Study Areas and its current use by traditional users. Identify the existing and historical land users including oil sands development, tourism, forestry, fishing, hunting, traditional plant harvesting, cultural use and outdoor recreation with specific regard given to the Aboriginal peoples. Determine the impact of development on these uses and identify possible mitigation strategies.



## 9.0 Socio-Economic Factors

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

- a) the selection of the Study Areas, information sources and assessment methods;
- b) the number and distribution of people who may be affected by the proposal;
- c) the social impacts of the Project on the Study Areas and on Alberta, including:
  - i) local employment and training;
  - ii) local procurement;
  - iii) population changes;
  - iv) demands on local services and infrastructure;
  - v) regional and provincial economic benefits;
  - vi) trapping, hunting and fishing; and
  - vii) effects on First Nations and Metis (e.g., traditional land use and culture);
- d) the economic impacts of the Project on the Study Areas and on Alberta, having regard for capital, labour and other operating costs and revenue from services. In addition, discuss IOR's policies and programs respecting the use of local, Alberta and Canadian goods and services. Provide an estimated breakdown of Alberta, other Canadian and non-Canadian industrial benefits from project management/engineering; equipment and materials; construction labour and total overall project;
- e) the employment and business development opportunities the Project may create for local communities and the region. Provide a breakdown of the type of employment and number of employees with respect for the construction and operational workforces. Identify the source of labour for the proposed Project; and
- f) strategies to mitigate socio-economic concerns raised by the Regional Municipality of Wood Buffalo and other stakeholders in the region. Include a discussion on the potential impacts to housing availability and the social ramifications of that impact. Document the work with other industry partners and the Regional Municipality to continue use and development of the urban population prediction model developed for baseline socio-economic purposes.

## 10.0 Public Consultation Requirements

Undertake a consultation program during the preparation of the EIA report including, but not limited to, the following stakeholders:

- a) residents in the Regional Municipality of Wood Buffalo;
- b) recognized land users of the Local Study Areas;
- c) local First Nations and Metis directly affected by the Project;
- d) industrial, recreational, environmental groups and individuals expressing a formal interest in the Project;
- e) Federal, Alberta and Saskatchewan governments, and Alberta local municipalities;
- f) directly-affected communities outside of Alberta; and
- g) other operating or potential oil sands developers in the region.

Describe and document the public consultation program implemented. Record any concerns or suggestions made by the public and demonstrate how these concerns have been addressed. Discuss:

- h) how the concerns and issues identified by IOR and stakeholders influenced the project development, design, impact mitigation and monitoring, or how it was addressed or discounted;
- i) the type of information provided and the issues discussed, including those that have been resolved and those that remain outstanding;
- j) in consideration of unresolved issues, the key alternatives which have been identified by IOR and stakeholders for future consultations;
- k) plans to maintain and support the public consultation process following completion of the EIA review; and
- l) any agreements reached with stakeholders regarding IOR's operations and activities.

## APPENDIX

*The following information is necessary to be submitted as part of the Application under the Water Act (WA) or the Environmental Protection and Enhancement Act (EPEA). It may not be necessary to be considered 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.*

### **Water Supply, Water Management and Wastewater Management**

Provide the following information for the Project:

- a) technical information on how the water requirements for the Project will be met;
- b) the design of facilities that will handle, treat and store wastewater streams;
- c) the type and quantity of any chemicals used in 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.

### **Conservation and Reclamation Plan**

Provide the following information for the Project within the context of a 10-year EPEA approval period:

- a) a plan for the integration of mining, reclamation activities and closure planning within the approval period, and within the Project life span. The plan should be consistent to that provided in the EUB application and demonstrate integration with the life of mine closure plan;
- b) a detailed schedule for annual mine development plans, and related reclamation activities;
- c) a detailed conservation and reclamation plan including, but not limited to, the following:
  - i) a discussion of soil reclamation requirements and a table of pre-disturbance land capability classes and post-disturbance land capability classes, demonstrating a return of equivalent land capability for commercial forest production in the development areas;
  - ii) predicted landscape, soil horizon/layer sequences of reclaimed soils that are likely to achieve equivalent land capability for commercial forest production at the development areas and discuss the possible assumptions and limitations of such approaches;
  - iii) a description and tables for approximate calculation/rating for pre- and post-disturbance land capability classes at the development areas;
  - iv) a discussion and tables of approximate reclamation material balance to achieve post-disturbance land capability ratings as specified in c) i) and ii);
  - v) the criteria to be used in soil salvage for reclamation;
  - vi) an assessment of sources/availability of suitable reclamation materials based on pre-disturbance soil information;
  - vii) soil salvage plans indicating salvage areas techniques, depths, types, quality and volumes of soils to be salvaged, and planned use of the materials with reference to reclamation material balance. Discuss whether organic soil materials (LFH and/or peat) will be salvaged or removed;
  - viii) the storage and handling of soils and potential locations for soils stockpiles; and
  - ix) methods to deal with potential soil compaction and contamination;

- d) a detailed description of the reclamation topography for all development areas, identifying contouring objectives, water development (surface and near-surface flow) and erosion control;
- e) a detailed reforestation plan that is integrated with soil and topography plans, that specify the ecosites and productivity proposed for the establishment of predevelopment capabilities for traditional land use, wildlife, commercial forestry, watershed and recreation; and
- f) possible mitigation options to reduce the potential impact from disturbance to key soil characteristics, re-vegetation practices, surface and groundwater properties.