

## **Part C**

# **Environmental Impact Assessment Methodology**



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## C. ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

### C.1 INTRODUCTION

This section provides an outline of the methodology that Southern Pacific Resource Corp. (STP) used to carry out the environmental impact assessment for the STP McKay Thermal Project – Phase 2.

Environmental Impact Assessment (EIA) is a process, and not a document or report. An EIA report is only one part of the EIA process. Beanlands and Duinker (1983) define an environmental impact assessment as a "*process or set of activities designed to contribute pertinent environmental information to project or program decision-making. In doing so, it attempts to predict or measure the environmental effects of specific human activities or do both, and to investigate and propose means of ameliorating those effects.*"

Five steps within the environmental impact assessment process are recognized:

- STEP 1. the project and EIA screening phase (*i.e.*, does the project meet EIA thresholds?);
- STEP 2. the scoping phase (*i.e.*, the preparation and finalization of the Terms of Reference – in general defining what environmental and social features will be evaluated, the spatial and temporal scale of evaluation, how features will be evaluated, and who will be involved);
- STEP 3. the environmental baseline study phase;
- STEP 4. the interpretive, predictive, mitigative and evaluative phase (*i.e.*, the preparation and review of an environmental assessment report); and
- STEP 5. the post-construction assessment phase (*i.e.*, monitoring and/or follow-up, and compliance).

For the Phase 2 Project, the EIA process is currently in the midst of the fourth step. Baseline environmental studies, as well as the Proponent's interpretation, prediction and evaluation of environmental and social impacts of the Phase 2 Project, have been completed. This report forms the latter stages of the fourth step of the EIA process; that is, the government and public review of STP's EIA report. Should the proposed project be approved, monitoring and/or follow-up during SAGD construction and operations will constitute the fifth and final step of the EIA process.

The EIA methodology used for the Phase 2 Project has been adopted from several sources [*e.g.*, Alberta Environment (2011); Morris and Therivel (2009); Noble (2006); Hanna (2005); Alberta Environment, Energy Resources Conservation Board, and Natural Resources Conservation Board (2000); Barnes et al. (1994); Beanlands and Duinker (1983); FEARO (1990); FEARO (1994); Hegmann et al. (1995); Hegmann et al. (1999); Roots (1994)] and has been used in the environmental evaluation of many resource and industrial projects. The methodology is practical, is technically sound, is familiar to both Alberta and Federal Government Review Agencies, and has received acceptance by the Federal Court of Canada. STP is of the view that the EIA carried out under this methodology for the Phase 2 Project is appropriate for allowing the decision-makers to make judgment as to whether the project is acceptable, should be approved, and is in the public interest.

## **C.2 ENVIRONMENTAL IMPACT ASSESSMENT CONSIDERATIONS**

### **C.2.1 ENVIRONMENTAL IMPACT ASSESSMENT REQUIREMENTS**

The requirements to carry out an EIA are outlined in both provincial and federal legislation. The Phase 2 Project application has been prepared to address EIA requirements under both Provincial and Federal legislation.

#### **Provincial Legislation**

Provincial regulatory requirements are outlined in Sections 39 through 59 of the Alberta *Environmental Protection and Enhancement Act* (EPEA). STP was advised by AENV that the Phase 2 Project is a mandatory activity pursuant to Schedule 1(j) of the *Environmental Assessment (Mandatory and Exempted Activities) Regulation*. In accordance with Section 44(1) of the EPEA, STP was instructed to prepare and submit an EIA report for the Phase 2 Project pursuant to the provisions of Part 2, Division 1 of the Act.

#### **Federal Legislation**

Federal EIA requirements are noted in Sections 15(3), and 16(1) (2) of the *Canadian Environmental Enhancement Act* (CEAA). At the time of application submission, STP has advised the Federal Government, through the Canadian Environmental Assessment Agency, that the CEAA does not apply to the Phase 2 Project as no federal “trigger” mechanisms have been identified and federal approvals will not be required. In the event that a “trigger” mechanism is subsequently identified during the review of this application, the document has been prepared to satisfy federal EIA requirements under CEAA.

## C.2.2 ENVIRONMENTAL IMPACT ASSESSMENT DEFINITIONS

As outlined by Beanlands and Duinker (1983), without a clear definition of terms used in an EIA document, the report can become subject to a wide range of interpretation by reviewers. To avoid any confusion in interpreting the information presented in this application by government and public reviewers, STP has provided a glossary of terms and abbreviations used in this report. For example:

**Project-specific effects** are changes that are predicted to occur to the biophysical or social environment caused solely by the Phase 2 Project as a result of the proposed activities included in the scope of the Project.

**Cumulative effects** are changes that are predicted to occur to the natural or social environment that are caused by the interaction of residual effects of the Project (*i.e.*, an effect remaining after the application of mitigation) with residual effects of other past, present and planned projects or activities, as defined in the EIA Terms of Reference.

The glossary of terms and abbreviations used in this report are presented in [Appendix III](#) of the Application

## C.2.3 PUBLIC DISCLOSURE DOCUMENT AND EIA TERMS OF REFERENCE

In March 2011, STP prepared a proposed Terms of Reference (ToR) for the STP McKay Thermal Project – Phase 2. This document marked the first step in the regulatory process for the Project. The ToR identifies the information that is required by government agencies to be considered and addressed in the preparation and submission of an EIA report for the Phase 2 Project. Further, a summary table was included with the intent to provide regulators, stakeholders and the public with information about the project and the anticipated project development timelines.

The proposed ToR for the Phase 2 Project was prepared with notice of its availability being publicly advertised in the daily newspapers in Edmonton (Journal and Sun), Calgary (Herald and Sun), Fort McMurray (Today) and the Alberta Sweetgrass in May 2011. Responses to the advertisement were requested by June 23, 2011. In addition STP also mailed the proposed ToR notice to several aboriginal communities and public stakeholders as per its Aboriginal Consultation Plan and its Public Consultation Plan.

Following the public comment period, and with input from the Federal Government, final Terms of Reference for the EIA were formally issued by AENV, pursuant to Section 48 of EPEA, on July 22, 2011.

In accordance with Section 49(n) of EPEA, a copy of the final EIA ToR for the Project is provided in [Appendix I](#) in the form of a concordance table, showing where each ToR item is addressed in the EIA Report. The ToR established the framework for the EIA addressed in this application.

The EIA ToR outlines the environmental assessment overview and expected outcomes from the process and states:

### ***SCOPE OF THE EIA REPORT***

*STP shall prepare and submit an EIA report that examines the environmental and socio-economic effects of the Project.*

*The EIA report shall be prepared considering all applicable provincial and federal legislation, codes of practice, guidelines, standards and directives.*

*The EIA report shall be prepared in accordance with these Terms of Reference and the environmental information requirements prescribed under EPEA and associated regulations, and the Canadian Environmental Assessment Act if applicable. The EIA report will form part of the Proponent's application to the Energy Resources Conservation Board (ERCB). An EIA report summary will also be included as part of the ERCB Application.*

*STP will refer to the Guide to Preparing Environmental Impact Assessment Reports in Alberta published by Alberta Environment (the Guide) and these Terms of Reference when preparing the Environmental Impact Assessment report. In any case where there is a difference in requirements between the Guide and these Terms of Reference, the Terms of Reference shall take precedence.*

The Application and EIA Report has been prepared to fulfil the requirements specified in the ToR, as well as the environmental information requirements prescribed under the EPEA and Regulations, the *Oil Sands Conservation Act* (OSCA) and federal legislation which applies to the Phase 2 Project. However, consistent with the iterative nature of EIA, this Application and EIA Report also addresses issues identified by government review agencies and directly-affected stakeholders during the collection of baseline environmental information and preparation of the EIA Report.

## **C.2.4 SCOPE OF ASSESSMENT**

### **C.2.4.1 Scope of the Project**

The scope of the Phase 2 Project for the purposes of the EIA includes all phases (construction, operation, decommissioning and reclamation) of the in situ steam assisted gravity drainage (SAGD) oil extraction operations and the associated facilities and infrastructure required to carry out these activities. Specifically, the scope of the Phase 2 Project includes:

- construction, operation and abandonment of a number of well pads and associated infrastructure (e.g., well pairs, access roads, power lines and pipelines) so that the

bitumen can be extracted from the oil sands reservoir and transferred to a central processing facility (CPF);

- construction, operation and abandonment of the CPF, where the bitumen is subjected to a number of processes before it is sent off site, via a pipeline, to an upgrader where it is subsequently refined into synthetic crude or other petroleum products;
- construction, operation and abandonment of a camp, established to house the Phase 2 Project's workforce;
- construction, operation and abandonment of a water supply system needed to provide water in the bitumen extraction processes; and
- construction, operation and abandonment of water management facilities that include domestic sewage treatment, settling impoundments, sumps, and ditches.

A full description of the scope of the Project is included in [Parts A](#) (Introduction) and [B](#) (Project Description) of this Application.

#### **C.2.4.2 Valued Environmental Components**

The Phase 2 Project EIA report has addressed impact concerns by identifying Valued Environmental Components (VECs). VECs for the Phase 2 Project are those environmental attributes associated with the proposed project development, which have been identified to be of concern either by directly-affected stakeholders, government or the professional community. They can be referred to as key indicators or parameters in the ToR. VECs consider both biophysical (*i.e.*, ecosystem) and socio-economic attributes because of the broad-based definition of environmental effect as outlined both in federal and provincial legislation.

In the Alberta EPEA, environmental effects must include an evaluation of the environmental, social, economic and cultural consequences of a project. Positive and negative impacts are to be assessed with an indication of plans the proponent will implement to manage negative impacts.

In the CEAA, an environmental effect refers to any change that the project may cause in the environment. This includes the effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by Aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. In contrast to the EPEA, only negative effects are analysed as per the CEAA.

For each VEC measurable parameters were selected, where possible and appropriate, to facilitate quantitative or qualitative measurement of potential Project effects and cumulative effects. Measurable parameters provide a means to determine the level or amount of change in a VEC. For example, a measure of total suspended solids might be chosen as the measurable parameter

for sedimentation effects in watercourses and on fish habitat and condition. Each environmental discipline was responsible for identifying and defining measurable parameters for their respective VECs. The degree of change in these measurable parameters was used to help characterize Project specific and cumulative effects and evaluate the residual effects. Thresholds or standards were identified, where possible and appropriate, for each measurable parameter.

A list of the VECs identified for the Phase 2 Project and the rationale for their selection is presented in [Part D](#), Environmental Impact Assessment and the respective Consultant Reports in the Application.

### C.2.4.3 Assessment Boundaries

Section 3.1 of Alberta Environments *Guide to Preparing Environmental Impact Assessment Reports* (Alberta Environment 2011b) gives guidance to establishing spatial boundaries, stating:

*“The Study Area for an EIA report includes the Project Area, and all of the Local Study Areas (LSA) and Regional Study Areas (RSA) assessed by the Proponent. The size and shape of the Project Area, Local Study Area and Regional Study Area should not be restricted by political boundaries.”*

The guidance on temporal boundaries is less prescriptive, simply recognizing that temporal scales vary based on project type and activities (Alberta Environment 2011b, p.6). Scientific rationale for the selection of temporal scale is to be provided.

The establishment of the boundaries for each of the disciplines studied represented a compromise involving limitations such as economic realities and the time and space scales over which natural systems operate. Beanlands and Duinker (1983) recognize five types of boundaries that should be considered in an EIA. These five types of boundaries have been assessed for the Phase 2 Project and are presented below:

- **Project Boundaries:** These boundaries are defined as those temporal and space limitations imposed by the Phase 2 Project's activities. For the Project, spatial limitations are confined to activities associated with development of in situ SAGD oil sands operations and related infrastructure, including access and utility corridors. The Project Area includes all lands subject to direct disturbance from the Project and associated infrastructure and is approximately 488.1 ha ([Figure A.1.3](#)).
- **Temporal Boundaries:** These boundaries have been defined as lasting approximately 25 years, concomitant with the life of the Phase 2 Project. Segments of the temporal boundaries include the duration of construction, operation and abandonment phases of the Phase 2 Project.



- **Administrative Boundaries:** These boundaries are time and space limitations imposed because of administrative or economic reasons. Spatially, the Project Area lies entirely within the Province of Alberta and as such the resources that are affected by the Phase 2 Project are subject to the jurisdiction of the Provincial and Municipal Governments. Should a federal department identify a “trigger” mechanism during the review of this project, this application has been prepared in compliance with federal legislation.
- **Ecological/Socio-economic Boundaries:** As identified by Beanlands and Duinker (1983), these boundaries are the most problematic boundaries to define for the impact assessment. This is due to the fact that there are both temporal and spatial limitations over which biological, social and economic systems function. Limitations will vary widely among species depending upon factors such as transport mechanisms, population cycles and recovery rates to pre-impact site conditions. For the Project, the Ecological/Socio-economic boundaries varied considerably both spatially and temporally. Temporal and spatial variability was dependent upon the particular discipline being studied.
- **Technical Boundaries:** The technical boundary identified for the Phase 2 Project is the time and space limitation imposed to evaluate or measure change. For example where time and space limitations precluded the collection of quantitative information, impact predictions were assessed on the basis of evaluations of professional judgment and/or experience from STP existing operations.

Based on the aforementioned criteria, [Table C.2.1](#) was prepared to assist in establishing the spatial and temporal dimensions for the study areas for each of the disciplines studied during the environmental impact assessment.

<b>Spatial Boundaries</b>	<b>Temporal Boundaries</b>
INTERNATIONAL: Impact could extend to international level	YEAR ROUND: Significant throughout the year
NATIONAL: Impact could extend to national level	SEASONAL: Significant on a seasonal basis, depending on nature of VEC
PROVINCIAL: Impact could extend to Provincial level	OCCASIONAL: Significance is intermittent
REGIONAL: Impact could extend to the region surrounding proposed project development area	CYCLICAL: Importance varies with cyclical changes over time
LOCAL: Impact limited to the local area in close proximity to the PDA	PERIODIC: Importance limited by period of Project development

(adapted from Barnes et al. 1993)

The Local Study Area (LSA) is established based on the zone of the Phase 2 Project influence, beyond which the potential environmental, cultural and socio-economic effects of the Phase 2

Project are expected to be non-detectable. The Regional Study Area (RSA) is established based on the extent to which it would be expected that the interaction of residual effects of the Phase 2 Project with the residual effects of other projects would be detectable. It is also the area in which socio-economic effects are expected to be detectable (Alberta Environment 2010). VEC-specific boundaries are established for both the LSA, for Project-specific effects, and the RSA, for cumulative effects. Effects on those VECs that have impacts more directly tied to the footprint of the Phase 2 Project are also assessed at the spatial scale of the project footprint.

The study area boundaries of each of the disciplines are shown in [Figure C.2.1](#) (LSA) and [Figure C.2.2](#) (RSA). The temporal boundaries range from the life of the Phase 2 Project (25 yrs) to well beyond (+50 yrs). The specific LSA and RSA spatial and temporal dimensions for each of the disciplines studied are discussed in [Part D](#) and in the respective Consultant Reports.

#### C.2.4.4 Assessment Cases

The Phase 2 Project EIA considers the following assessment scenarios, as per the ToR and the Guideline for Preparing EIA reports (Alberta Environment 2011b):

- a) **Baseline Case**, which includes existing environmental conditions and existing projects or “approved” activities;
- b) **Application Case**, which includes the Baseline Case plus the Phase 2 Project; and
- c) **Planned Development Case (Cumulative Effects)**, which includes the “Application Case” combined with past studies, existing and anticipated future environmental conditions, existing projects or activities, plus other “planned” projects or activities.

For the purposes of defining assessment scenarios, “approved” means approved by any federal, provincial or municipal regulatory authority, and “planned” means any project or activity that has been publicly disclosed prior to the issuance of the Phase 2 Project’s Terms of Reference or up to six months prior to the submission of the Phase 2 Project Application and the EIA report, whichever is most recent.

Existing, approved and planned projects and activities in the region considered in the assessment are listed in [Table C.2.2](#) and are shown on [Figure C.2.3](#). Local and Regional Study Areas vary in size for each of the VECs, as discussed in [Section C.2.4.3](#). The project list provided in [Table C.2.2](#) was generated to capture all projects found within the second largest RSA, that is, the air quality RSA. As can be seen on [Figure C.2.3](#), not all Projects are contained within the study areas of each of the respective disciplines.

<b>Table C.2.2 List of Existing, Approved and Planned (Reasonably Foreseeable) Projects</b>				
<b>Company</b>	<b>Project</b>	<b>Existing &amp; Approved Activity (Baseline Case)</b>	<b>Project Only (Application Case)</b>	<b>Planned Activity (Reasonably Foreseeable) (CEA Case)</b>
<b>Oil Sands Mining Operations</b>				
Albian Sands	Muskeg River Mine & Expansion	<input checked="" type="checkbox"/>		
CNRL	Horizon	<input checked="" type="checkbox"/>		
Imperial Oil	Kearl	<input checked="" type="checkbox"/>		
Shell	Jackpine Phase 1 Mine	<input checked="" type="checkbox"/>		
	Jackpine Expansion			<input checked="" type="checkbox"/>
	Pierre River Mine			<input checked="" type="checkbox"/>
Suncor	Base Plant and Millennium	<input checked="" type="checkbox"/>		
	Dump 9 Area	<input checked="" type="checkbox"/>		
	Steepbank Extension	<input checked="" type="checkbox"/>		
	South Tailings Pond	<input checked="" type="checkbox"/>		
	Upgrader Complex	<input checked="" type="checkbox"/>		
	Voyageur	<input checked="" type="checkbox"/>		
	Fort Hills (formerly Petro-Canada)	<input checked="" type="checkbox"/>		
	Voyageur South			<input checked="" type="checkbox"/>
Syncrude	Mildred Lake, with Emission Reduction	<input checked="" type="checkbox"/>		
	Aurora North	<input checked="" type="checkbox"/>		
	Aurora South	<input checked="" type="checkbox"/>		
	Southwest Sand Storage Conversion			<input checked="" type="checkbox"/>
Total E&P Joslyn	Joslyn North Mine Project	<input checked="" type="checkbox"/>		
UTS/Teck Cominco	Equinox Mine			<input checked="" type="checkbox"/>
	Frontier Mine			<input checked="" type="checkbox"/>
<b>Oil Sands In-Situ Operations</b>				
Alberta Oil Sands Inc.	Clearwater West SAGD Pilot			<input checked="" type="checkbox"/>
Athabasca Oilsands Corp.	Dover Pilot			<input checked="" type="checkbox"/>
	MacKay River Pilot	<input checked="" type="checkbox"/>		
CNRL	Horizon In Situ			<input checked="" type="checkbox"/>
	Kirby (Enerplus)	<input checked="" type="checkbox"/>		

**Table C.2.2 List of Existing, Approved and Planned (Reasonably Foreseeable) Projects**

Company	Project	Existing & Approved Activity (Baseline Case)	Project Only (Application Case)	Planned Activity (Reasonably Foreseeable) (CEA Case)
Connacher	Great Divide Pod One Project	<input checked="" type="checkbox"/>		
	Algar Project	<input checked="" type="checkbox"/>		
	Great Divide SAGD Expansion Project			<input checked="" type="checkbox"/>
ConocoPhillips	Surmont Pilot & Commercial Phases	<input checked="" type="checkbox"/>		
Dover Operating Corp.	McKay River Central			<input checked="" type="checkbox"/>
	McKay River North			<input checked="" type="checkbox"/>
	Dover North			<input checked="" type="checkbox"/>
	Dover Central			<input checked="" type="checkbox"/>
E-T Energy	Poplar Creek In-Situ	<input checked="" type="checkbox"/>		
Excelsior	Hangingstone Pilot			<input checked="" type="checkbox"/>
Grizzly	Algar Lake			<input checked="" type="checkbox"/>
Husky	Sunrise Thermal Project	<input checked="" type="checkbox"/>		
	Muskwa River GP	<input checked="" type="checkbox"/>		
Ivanhoe	Tamarack			<input checked="" type="checkbox"/>
JACOS	Hangingstone Pilot	<input checked="" type="checkbox"/>		
	Hangingstone Commercial			<input checked="" type="checkbox"/>
KNOC (Harvest Energy)	Blackgold Initial Project	<input checked="" type="checkbox"/>		
Koch Exporation	Pilot			<input checked="" type="checkbox"/>
Laricina	Saleski Pilot	<input checked="" type="checkbox"/>		
	Saleski Phase 1			<input checked="" type="checkbox"/>
	Germain 5K	<input checked="" type="checkbox"/>		
	Germain Phases 2 to 4			<input checked="" type="checkbox"/>
OPTI/Nexen	Long Lake	<input checked="" type="checkbox"/>		
	Long Lake South			<input checked="" type="checkbox"/>
Southern Pacific	McKay Thermal Project – Phase 1	<input checked="" type="checkbox"/>		
	McKay Thermal Project – Phase 2		<input checked="" type="checkbox"/>	
StatOil	Leismer Pilot	<input checked="" type="checkbox"/>		
	Kai Kos Dehseh			<input checked="" type="checkbox"/>

<b>Table C.2.2 List of Existing, Approved and Planned (Reasonably Foreseeable) Projects</b>				
<b>Company</b>	<b>Project</b>	<b>Existing &amp; Approved Activity (Baseline Case)</b>	<b>Project Only (Application Case)</b>	<b>Planned Activity (Reasonably Foreseeable) (CEA Case)</b>
Suncor	Dover In-Situ	<input checked="" type="checkbox"/>		
	Firebag In Situ (Stages 1 to 3)	<input checked="" type="checkbox"/>		
	Firebag In Situ (Stages 4 to 6)	<input checked="" type="checkbox"/>		
	McKay River Project & Expansion	<input checked="" type="checkbox"/>		
	Lewis			<input checked="" type="checkbox"/>
	Meadow Creek	<input checked="" type="checkbox"/>		
Sunshine Oilsands	West Ells SAGD			<input checked="" type="checkbox"/>
Value Creation Inc.	Terre de Grace (now BP)	<input checked="" type="checkbox"/>		
	TriStar Pilot			<input checked="" type="checkbox"/>
<b>Other Operations</b>				
Altagas	Marianna Lake	<input checked="" type="checkbox"/>		
	North Hoole Compressor Station	<input checked="" type="checkbox"/>		
	Thornbury Burnt Pine	<input checked="" type="checkbox"/>		
	Thornbury Hangingstone	<input checked="" type="checkbox"/>		
Birch Mountain	Muskeg Valley Quarry & Hammerstone Project	<input checked="" type="checkbox"/>		
CNRL	Algar Compressor Station	<input checked="" type="checkbox"/>		
	Britnell Oil Battery and Compressor Station	<input checked="" type="checkbox"/>		
	Grew lake North Compressor Station	<input checked="" type="checkbox"/>		
	Horizon Compressor Station	<input checked="" type="checkbox"/>		
	Jean Lake Compressor Station	<input checked="" type="checkbox"/>		
	Kettle River Compressor Station	<input checked="" type="checkbox"/>		
	Liege Compressor Station	<input checked="" type="checkbox"/>		
	Newby Sour Gas Plant	<input checked="" type="checkbox"/>		
	Paramount Liege	<input checked="" type="checkbox"/>		
	Pelican Compressor Station	<input checked="" type="checkbox"/>		
	Terragon Jean Lake Compressor Station	<input checked="" type="checkbox"/>		
Cenovus	Birch Mountain	<input checked="" type="checkbox"/>		
	Ells River Compressor Station	<input checked="" type="checkbox"/>		
Devon	Hangingstone	<input checked="" type="checkbox"/>		
	West Surmont	<input checked="" type="checkbox"/>		
Encana	Compressor Stations	<input checked="" type="checkbox"/>		

**Table C.2.2 List of Existing, Approved and Planned (Reasonably Foreseeable) Projects**

Company	Project	Existing & Approved Activity (Baseline Case)	Project Only (Application Case)	Planned Activity (Reasonably Foreseeable) (CEA Case)
Husky Oil	Thornbury North	<input checked="" type="checkbox"/>		
Northlands Forest Products	Sawmill	<input checked="" type="checkbox"/>		
Northstar Energy	Compressor	<input checked="" type="checkbox"/>		
Paramount Energy	Corner Compressors	<input checked="" type="checkbox"/>		
	Saleski	<input checked="" type="checkbox"/>		
	Devon Muskwa	<input checked="" type="checkbox"/>		
	Devon Woodenhouse	<input checked="" type="checkbox"/>		
	Kettle Compressor Station	<input checked="" type="checkbox"/>		
	Legend	<input checked="" type="checkbox"/>		
	Liege	<input checked="" type="checkbox"/>		
	Quigley Compressor Station	<input checked="" type="checkbox"/>		
Parsons Creek	Limestone Quarry			<input checked="" type="checkbox"/>
Williams Energy	Fort McMurray Plant	<input checked="" type="checkbox"/>		
Misc.	Gas Production Facilities	<input checked="" type="checkbox"/>		
	Communities and Highways	<input checked="" type="checkbox"/>		
	Forecasted growth of communities and increase in traffic			<input checked="" type="checkbox"/>

#### C.2.4.5 Cumulative Effects

The requirement to assess cumulative effects is legislated under both EPEA [Section 49(d)] and the CEAA [Section 16(1)(a)]. The ERCB/AENV/NRCB Information Letter “*Cumulative Effects Assessment in Environmental Impact Assessment Reports under the Alberta Environmental Protection and Enhancement Act*,” (June 2000) provides additional guidance with respect to cumulative effects assessment.

STP identified the cumulative effects resulting from the Phase 2 Project when combined with those of other existing, approved and planned projects in the region. As outlined in [Section C.2.4.3](#), the cumulative environmental effects assessment boundaries vary for each discipline. Existing, approved and planned projects in the region considered in the cumulative effects assessment are listed in [Table C.2.2](#).

### C.2.5 STEPS IN THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The steps used to conduct the EIA for the Phase 2 Project are shown in [Table C.2.3](#) and described in this Section.

<b>Table C.2.3 Steps Used to Conduct the Environmental Impact Assessment</b>	
<b>Step</b>	<b>Task</b>
1. Scoping	Identify local and regional issues of concern
	Select local and regional VECs
	Identify spatial and temporal boundaries for each resource discipline to encompass the respective VECs
	Identify potential impacts (project and cumulative) due to actions and possible effects
2. Analysis of Effects and Identification of Mitigation	Complete the collection of local and regional baseline data
	Assess effects of proposed project action and other cumulative actions on selected VECs
	Recommend mitigation measures
3. Impact Rating	Characterize residual effects
	Compare results against defined thresholds, such as standards, guidelines, land use objectives and trends, or other defined thresholds
	Determine impact rating of project and cumulative effects on selected VECs
4. Follow-up	Recommend monitoring and effect management

#### C.2.5.1 Scoping

The purpose of the scoping exercise was to define the Phase 2 Project and identify local and regional issues of concern, the VECs, the VECs' study area boundaries and potential project and cumulative impacts.

Issues of concern were identified based on:

- concerns expressed by government, the professional community, and directly-affected stakeholders;
- EIA ToR;
- review of legislation;
- consideration of available reference material and literature;
- previous assessment experience including proposed developments in the Phase 2 Project study areas; and
- issues and concerns related to resources traditionally used by indigenous peoples.

Based on the evaluation of these issues, VECs for the Phase 2 Project were identified. Throughout the EIA process, new VECs were identified and grouped into the appropriate resource discipline. Generally, Phase 2 Project VECs were selected for analyses based on the extent of the interaction between the Phase 2 Project and the issue of concern. For some VECs, key questions were also developed to focus the assessment.

Spatial and temporal boundaries for each resource discipline were established to encompass the respective VECs. Potential project and cumulative activities for each VEC were identified. A list of the VECs identified for the Phase 2 Project for each environmental discipline is presented in [Part D](#) and in the respective Consultant Reports. The rationale for the selection of the respective VECs is presented in the relevant Consultant Reports.

### **C.2.5.2 Analysis of Effects and Identification of Mitigation**

Baseline conditions for each VEC were described based on existing information and Project-specific investigations. Once baseline conditions for the resource were determined and project activities were defined, an evaluation was carried out to determine whether environmental protection measures were required to mitigate impacts on the VEC.

The assessment of effects of the Phase 2 Project involved the prediction and evaluation of changes to VECs arising directly from the Phase 2 Project (*i.e.*, Project Effects), as well as effects arising from the Phase 2 Project in combination with past, present and planned projects or activities (*i.e.*, Cumulative Effects).

The assessment of the effects of interactions between the Phase 2 Project and environment for each VEC is presented in tabular form for each discipline, as shown in [Table C.2.4](#). Assessment of potential Project-specific effects on the environment was based on a combination of objective (measurable) and subjective (deduced) evaluations that were specific to the VEC being considered. The evaluation considered those protection or mitigation measures which would be required to meet either regulatory, company or public acceptance during routine planning/design, construction, operation and/or abandonment phases of the Phase 2 Project. In addition, likely accidents and/or malfunctions were considered in the assessment.

The CEAA defines mitigation as “*the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.*” (*Canadian Environmental Assessment Act, 1992*).

Mitigation is often achieved through iterative Project design, for example through site selection to avoid sensitive areas and application of best practices during construction. Additional



mitigation measures, over and above mitigation integrated into Project design, were identified for each effect, as required. Types of mitigation measures that were considered included:

- environmental protection measures and protocols;
- site-specific measures (*i.e.*, timing of activities to avoid biologically sensitive periods, site-specific mitigation design measures); and
- contingency measures to address the possibility of accidental events that could affect the environment.

### C.2.5.3 Impact Rating

Impact assessments are based upon AENV's *Guideline for Preparing EIA Reports* (Alberta Environment 2011b) and measured, estimated, or reasonably expected changes in some attributes of a selected receptor. These receptors or key resources are considered representative of the larger environment, with the assumption that if little to no impact to the receptor is identified, the broader environment will not be impacted. The identification of receptors is dependent upon scientific understanding of the respective ecological components and their interactions in the overall environment within which the Phase 2 Project will be developed. Work activity is guided both by issues identified during the course of impact assessment and in response to the ToR for the Phase 2 Project.

For each identified receptor, an assessment of the potential impact is made using the attributes of direction, geographic extent, magnitude, duration, likelihood, reversibility, and confidence in the relationships between cause and effect. An overall impact assessment rating for each receptor is derived based upon the individual attributes.

A residual Project impact is defined as an effect that cannot be fully reversed. Thus, the quantification and description of a residual Project impact, by definition, includes consideration of available mitigation procedures and opportunities. Impacts discussed in this EIA include those occurring due to the maximum disturbance scenario (*e.g.*, all Project components developed and operating at one time) and those impacts remaining after mitigation and reclamation activities have been completed (*i.e.*, the residual Project impacts).

The definition of the attributes used in the assessment is described below. Some specific definitions and certain attributes that pertain to a specific component are included in that component.

These attributes include:

- Magnitude;

- Geographic Extent;
- Duration;
- Frequency;
- Reversibility; and
- Ecological Context.

Alberta Environment and the CEAA provide additional guidance regarding these criteria as follows:

- **Magnitude of the Impact:** Alberta Environment defines magnitude as “*a measure of how adverse or beneficial an effect may be*” (Alberta Environment 2010). Guidance on magnitude from the CEA Agency is as follows: “*Magnitude refers to the severity of the adverse environmental effects. Minor or inconsequential effects may not be significant. On the other hand, if the effects are major or catastrophic, the adverse environmental effects will be significant. When using this criterion, it is important to consider the extent to which the project could trigger or contribute to any cumulative environmental effects.*” (FEARO, 1994)
- **Geographic Extent:** Alberta Environment defines geographic extent as “*spatial boundaries within which an effect of a defined magnitude occurs*” (Alberta Environment 2010). Guidance on geographic extent from the CEA Agency is as follows: “*Localized adverse environmental effects may not be significant. Alternatively, widespread effects may be significant. When considering this criterion, it will be important to take into account the extent to which adverse environmental effects caused by the project may occur in areas far removed from it (e.g., acid rain and the long-range transportation of atmospheric pollutants), as well as contribute to any cumulative environmental effects.*” (FEARO, 1994)
- **Duration and Frequency:** Alberta Environment defines duration as “*the period of time in which an effect on a valued ecosystem component may exist or remain detectable*” and defines frequency as “*the number of times during the life of the Project that the effect may occur*” (Alberta Environment 2010). Guidance on duration and frequency from the CEA Agency is as follows: “*Long term and/or frequent adverse environmental effects may be significant. Future adverse environmental effects should also be taken into account. For example, many human cancers associated with exposure to ionizing radiation have long latency periods of up to 30 years. Obviously when considering future adverse environmental effects, the question of their likelihood becomes very important.*” (FEARO, 1994)
- **Degree to which the Effects are Reversible or Irreversible:** Alberta Environment defines reversibility as “*capability of the environment to return to a capacity or condition*

*equivalent to the baseline after the impact ceases” (Alberta Environment 2010).*

Guidance on reversibility from the CEA Agency is as follows: *“Reversible adverse environmental effects may be less significant than adverse environmental effects that are irreversible. In practice, it can be difficult to know whether the adverse environmental effects of a project will be irreversible or not. It will be important to consider any planned decommissioning activities that may influence the degree to which the adverse environmental effects are reversible or irreversible.” (FEARO, 1994)*

- **Ecological Context:** *“The adverse environmental effects of projects may be significant if they occur in areas or regions that:
 
    - have already been adversely affected by human activities; and/or
    - are ecologically fragile and have little resilience to imposed stresses.”* (FEARO, 1994)
- **Environmental Standards, Guidelines, or Objectives:** *“If the level of an adverse environmental effect is less than the standard, guideline, or objective, it may be insignificant. If, on the other hand, it exceeds the standard, guideline, or objective it may be significant.” (FEARO, 1994)*

Criteria	Criteria Definition <sup>1</sup>	
Magnitude	Nil	No change from background conditions anticipated after mitigation.
	Low	Disturbance predicted to be somewhat above typical background conditions, but well within established or accepted protective standards and normal socio-economic fluctuations, or to cause no detectable change in ecological, social or economic parameters.
	Moderate	Disturbance predicted to be considerably above background conditions but within scientific and socio-economic effects thresholds, or to cause a detectable change in ecological, social or economic parameters within range of natural variability.
	High	Disturbance predicted to exceed established criteria or scientific and socio-economic effects thresholds associated with potential adverse effect, or to cause a detectable change in ecological, social or economic parameters beyond the range of natural variability.
Geographic Extent of Impact	Local	Effects occurring mainly within or close proximity to the proposed development area.
	Regional	Effects extending outside of the project boundary to regional surroundings.
	Provincial	Effects extending outside of the regional surroundings, but within provincial boundary.
	National	Effects extending outside of the provincial surroundings, but within national boundary
	Global	Effects extending outside of national boundary.

<b>Table C.2.4 Evaluation Criteria for Assessing the Environmental Impact</b>		
<b>Criteria</b>	<b>Criteria Definition<sup>1</sup></b>	
Duration of Impact	Short	Effects occurring within development phase
	Long	Effects occurring after development and during operation of facility
	Extended	Effects occurring after facility closes but diminishing with time.
	Residual	Effects persisting after facility closes for a long period of time.
Frequency	Continuous	Effects occurring continually over assessment periods.
	Isolated	Effects confined to a specified period ( <i>e.g.</i> , construction)
	Periodic	Effects occurring intermittently but repeatedly over assessment period ( <i>e.g.</i> , routine maintenance activities).
	Occasional	Effects occurring intermittently and sporadically over assessment period
Ability for Recovery	Reversible in short-term	Effects which are reversible and diminish upon cessation of activities.
	Reversible in long-term	Effects which remain after cessation of activities but diminish with time.
	Irreversible - Rare	Effects which are not reversible and do not diminish upon cessation of activities and do not diminish with time.
Project Contribution	Neutral	No net benefit or loss to the resource, communities, region or province.
	Positive	Net benefit to the resource, community, region or province.
	Negative	Net loss to the resource, community, region or province.
Confidence Rating	Low	Based on incomplete understanding of cause-effect relationships and incomplete data pertinent to study area.
	Moderate	Based on good understanding of cause-effect relationships using data from elsewhere or incompletely understood cause-effect relationship using data pertinent to study area.
	High	Based on good understanding of cause-effect relationships and data pertinent to study.
Probability of Occurrence Ecological Context	Low	Unlikely
	Medium	possible or probable
	High	Certain
Impact Rating	No Impact	No adverse effects are predicted.
	Low Impact	Effects are predicted to be within the range of natural variability and below guideline or threshold levels.
	Moderate Impact	Effects may exceed natural variability and/or guideline or threshold levels during phases of the project but recovery or restoration is considered feasible.
	High Impact	Effects of the project are predicted to cause irreversible changes to the sustainability or integrity of a population or resource.

<sup>1</sup> Criteria provide general direction for the environmental assessment, some modification may and will occur within the individual disciplines

In all attributes there are both objective and subjective considerations. Objective considerations include quantitative comparisons between predicted residual project impacts and established quantitative limits such as ambient air objectives and water quality guidelines, regional environmental objectives, and forestry harvest quotas. Subjective considerations, or professional judgements, are required when impacts cannot be predicted quantitatively due to limited data availability or when there are no benchmarks against which to compare predicted quantitative impacts.

For each individual impact assessment, a final impact rating of low, moderate, or high is stated. This is based upon the integration of quantitative analysis (where possible) and professional judgement that takes into account the various rankings for each attribute (direction, magnitude, geographic extent, duration, likelihood, reversibility, and confidence). This is applied to both the Project-specific impact and cumulative effects assessments.

Table C.2.5 Example Summary of Impact Rating on Valued Environmental Components (VECs)												
VEC	Nature of Potential Impact or Effect	Mitigation/Protection Plan	Type of Impact or Effect	Geographical Extent <sup>1</sup>	Duration <sup>2</sup>	Frequency <sup>3</sup>	Reversability <sup>4</sup>	Magnitude <sup>5</sup>	Project Contribution <sup>6</sup>	Confidence Rating <sup>7</sup>	Probability of Occurrence <sup>8</sup>	Impact Rating <sup>9</sup>
<b>1. List the VEC</b>												
			Application									
			Cumulative									
<b>2. List the VEC</b>												
			Application									
			Cumulative									
<b>3. List the VEC</b>												
			Application									
			Cumulative									
<b>4. List the VEC</b>												
			Application									
			Cumulative									
<b>5 List the VEC</b>												
			Application									
			Cumulative									

1. Local, Regional, Provincial, National, Global

2. Short, Long, Extended, Residual

3. Continuous, Isolated, Periodic, Occasional

4. Reversible in short term, Reversible in long term, Irreversible - rare

5. Nil, Low, Moderate, High

6. Neutral, Positive, Negative

7. Low, Moderate, High

8. Low, Medium, High

9. No Impact, Low Impact, Moderate Impact, High Impact

## C.2.6 FOLLOW-UP AND MONITORING

Once residual Project-specific environmental effects and their contribution to cumulative effects have been assessed, a follow-up program or monitoring program might be necessary. The CEAA has defined follow-up programs as a program for verifying that “*the environmental assessment was accurate and the mitigative measures were effective*”. (CEAA 2011).

Follow-up programs might be warranted when:

- there is a need to address project-related issues of concern;
- there is a need to test the accuracy of the predictions of the environmental assessment;
- there is a need to verify that mitigation measures were effective or successful;
- environmental effects of a project were assessed using new or unproven analytical or modelling techniques or the proposed project involves technology or mitigation measures that are new or unproven;
- there is limited experience implementing the type of project being proposed in the environmental setting under consideration; or
- scientific knowledge used to predict the environmental effects of the proposed project is limited.

Follow-up programs can be time and resource intensive and are only required where there is an identified need for a program based on the criteria set out above. In some instances, a monitoring program might adequately address issues and ensure the environment is protected.

Monitoring typically refers to a program designed to:

- confirm the effectiveness of a broad range of approved mitigation techniques;
- determine whether increased or different approved mitigation techniques are required to achieve mitigation or reclamation goals; and
- identify and address actual effects that were not predicted.

Recommended follow-up and monitoring programs are identified for specific disciplines in [Part D](#) and in the respective Consultant Reports. If a follow-up or monitoring program is recommended, recommendations are provided with respect to:

- parameters to be measured;
- methods and equipment to be used;
- location and timing of surveys; and

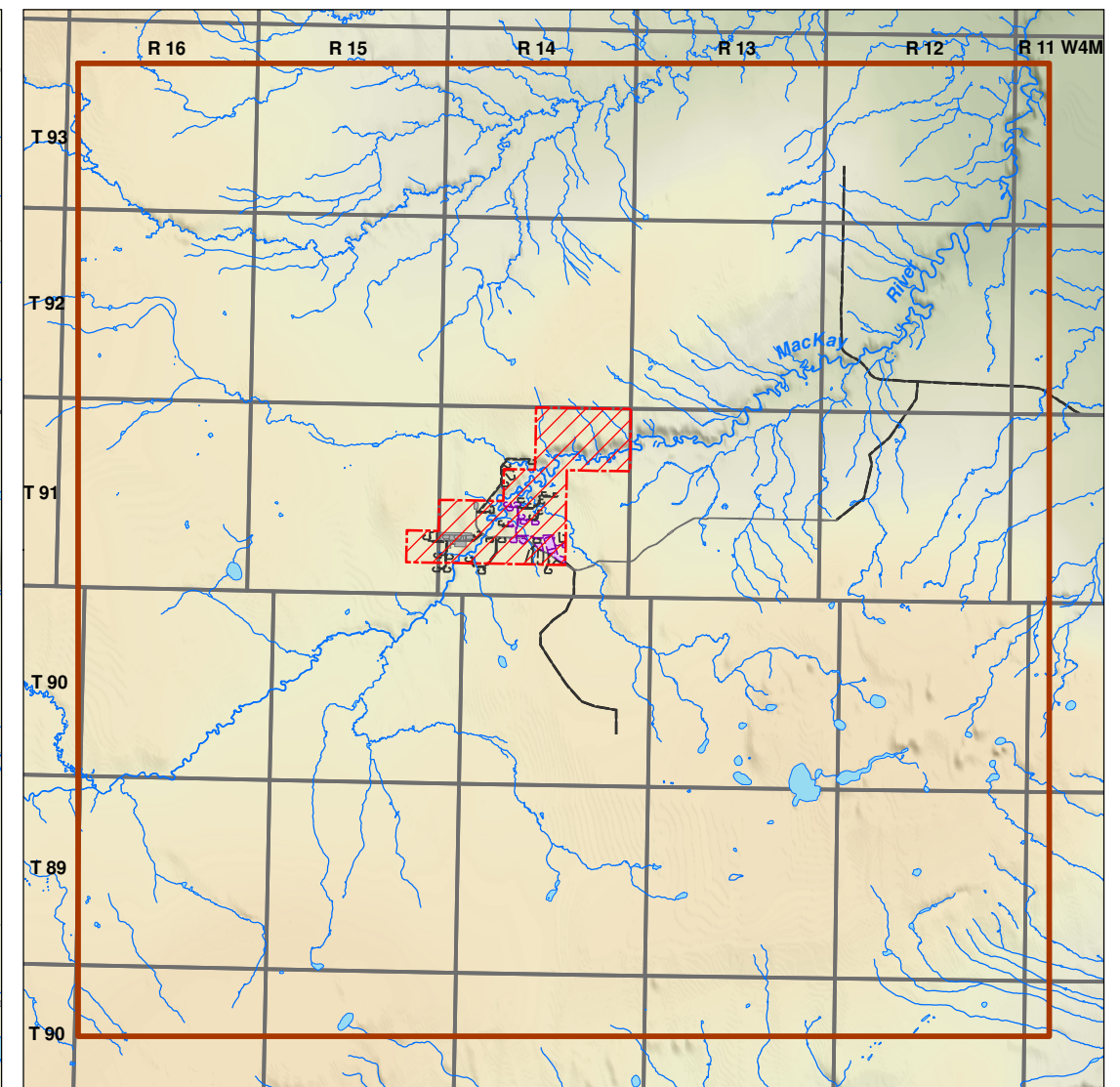
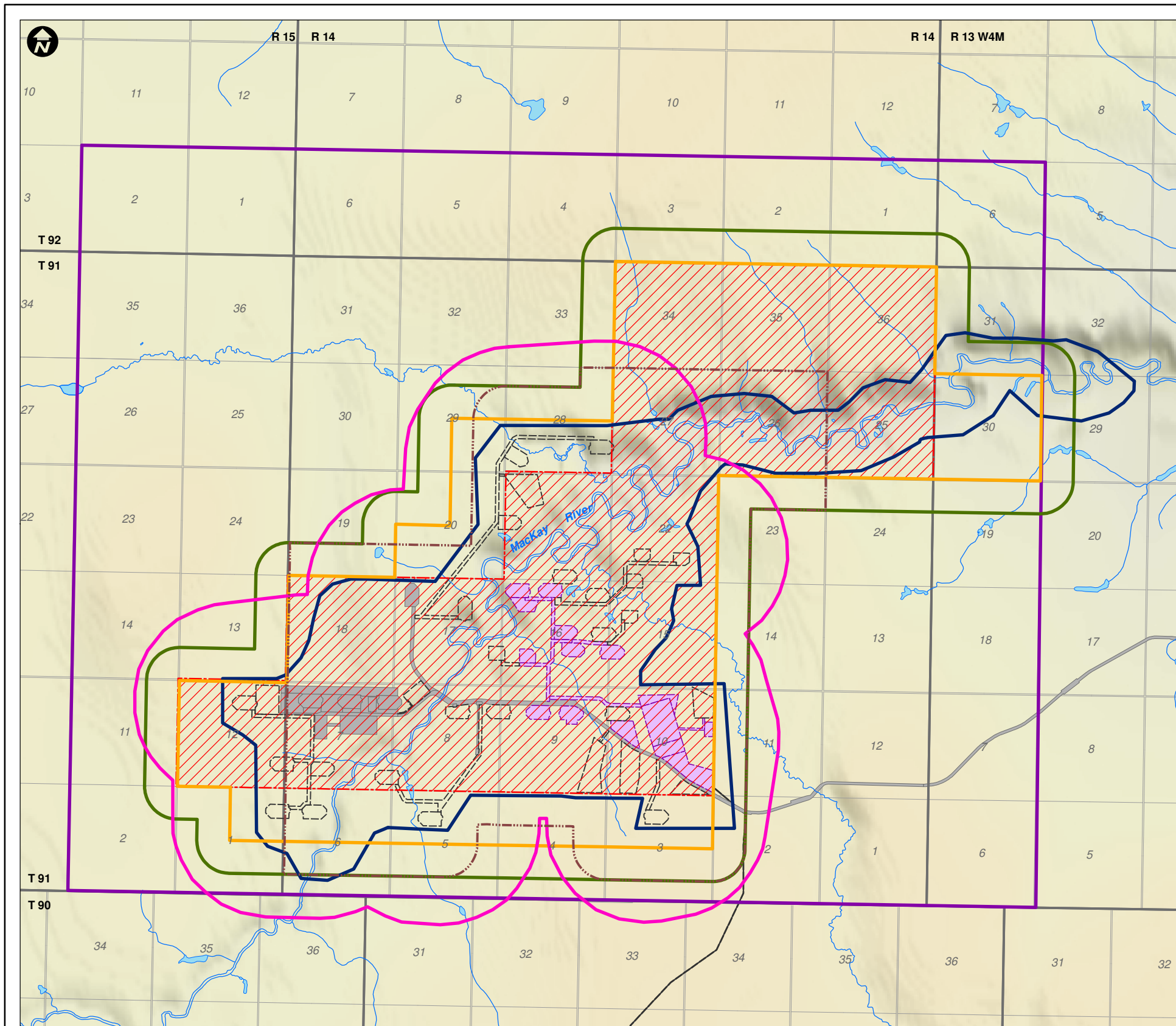
- how results of the follow-up or monitoring program will be applied, including consideration of an adaptive management approach.

### **C.3 APPLICATION OF THE METHODOLOGY**

Based on the above-described methodology, the EIA for the Phase 2 Project focused on the effects that the Phase 2 Project would have on the identified VECs in combination with other activities in the region over the anticipated 25 year economic life of the Phase 2 Project.

Based on the input received during the public consultation program, advice from regulatory agencies, and the professional community participants that worked on the Phase 2 Project, STP is confident that the methodology and approach used to conduct the EIA has enabled a comprehensive and accurate assessment of the effects of the Phase 2 Project.





**Legend**

- |                                   |                                      |   |
|-----------------------------------|--------------------------------------|---|
| Air Quality and Health LSA        | Existing Phase 1 Development         | <b>Topography (masl)</b><br><br>High : 525<br>Low : 250 |
| Archaeological LSA                | Proposed Initial Phase 2 Development |   |
| Aquatics LSA                      | Proposed Future Development          |   |
| Groundwater LSA                   | Streams with Defined Channels        |   |
| Soils, Hydrology and Wildlife LSA | Water Body                           |   |
| Noise LSA                         |                                      |   |
| Vegetation LSA                    |                                      |   |
| Project Area                      |                                      |   |

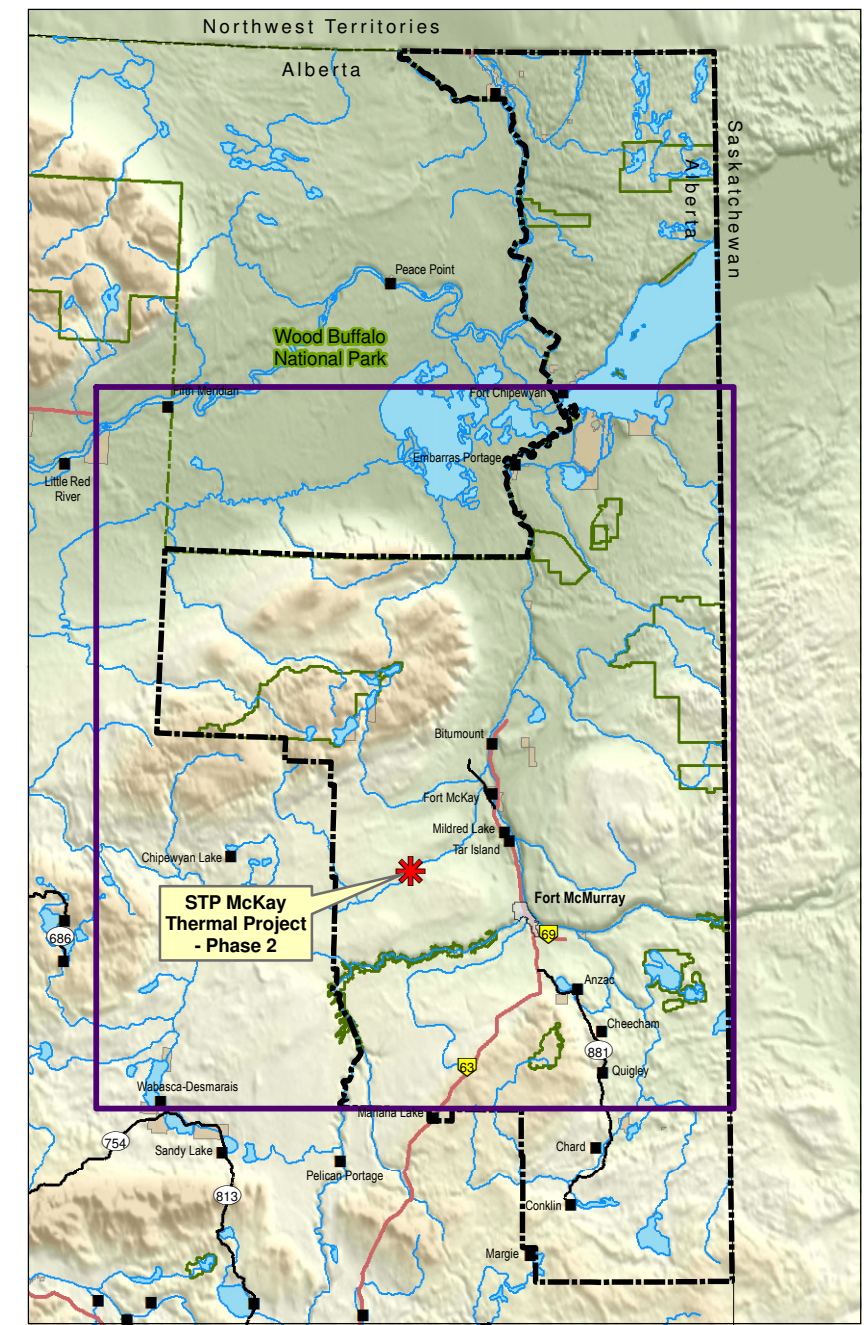
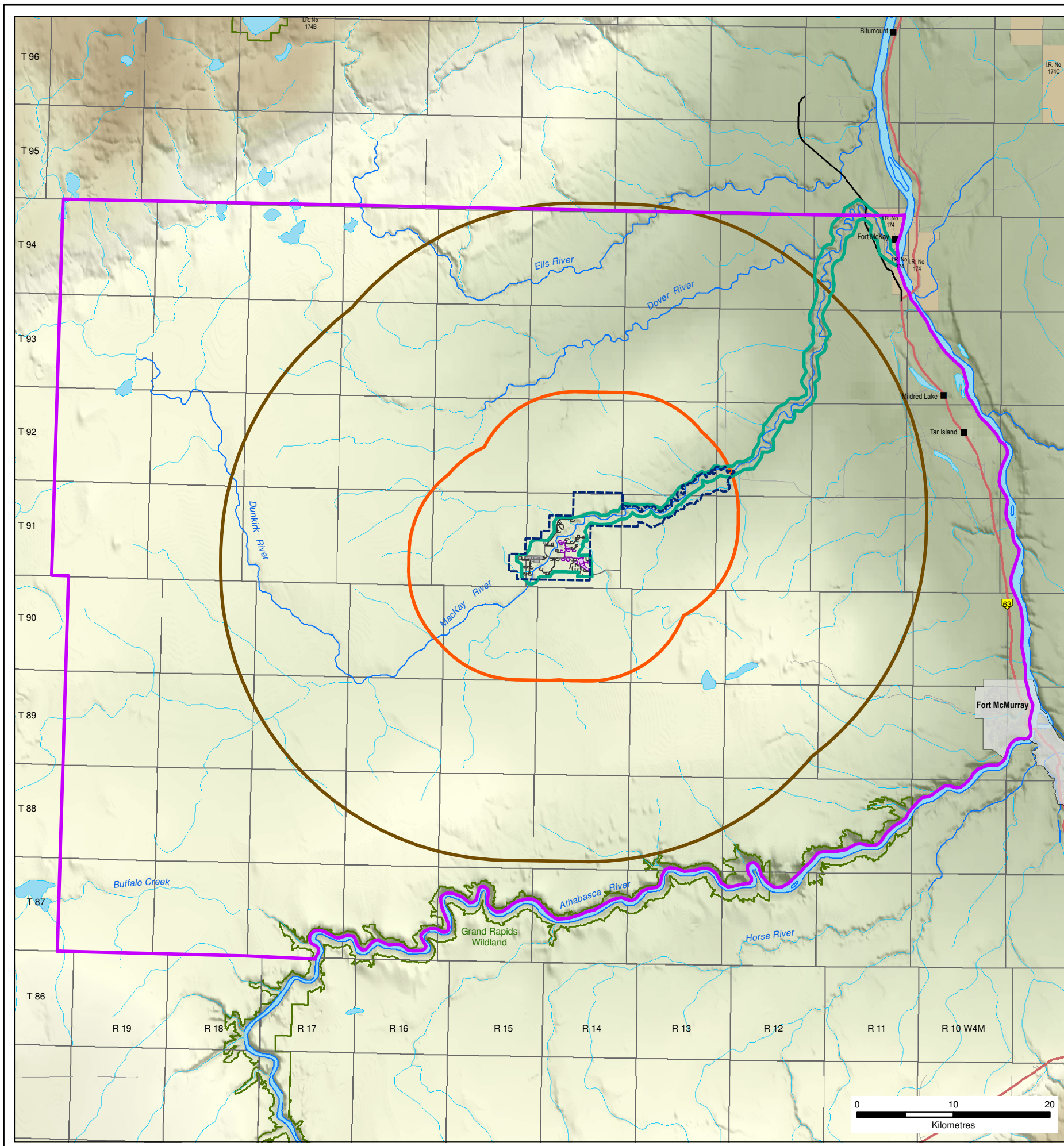


**STP McKay Thermal Project - Phase 2**

TITLE:  
**Local Study Areas (LSA) Used for the Environmental Impact Assessment**

DRAWN: SL  
CHECKED: KY  
DATE: Nov 8/11  
PROJECT: 10-037

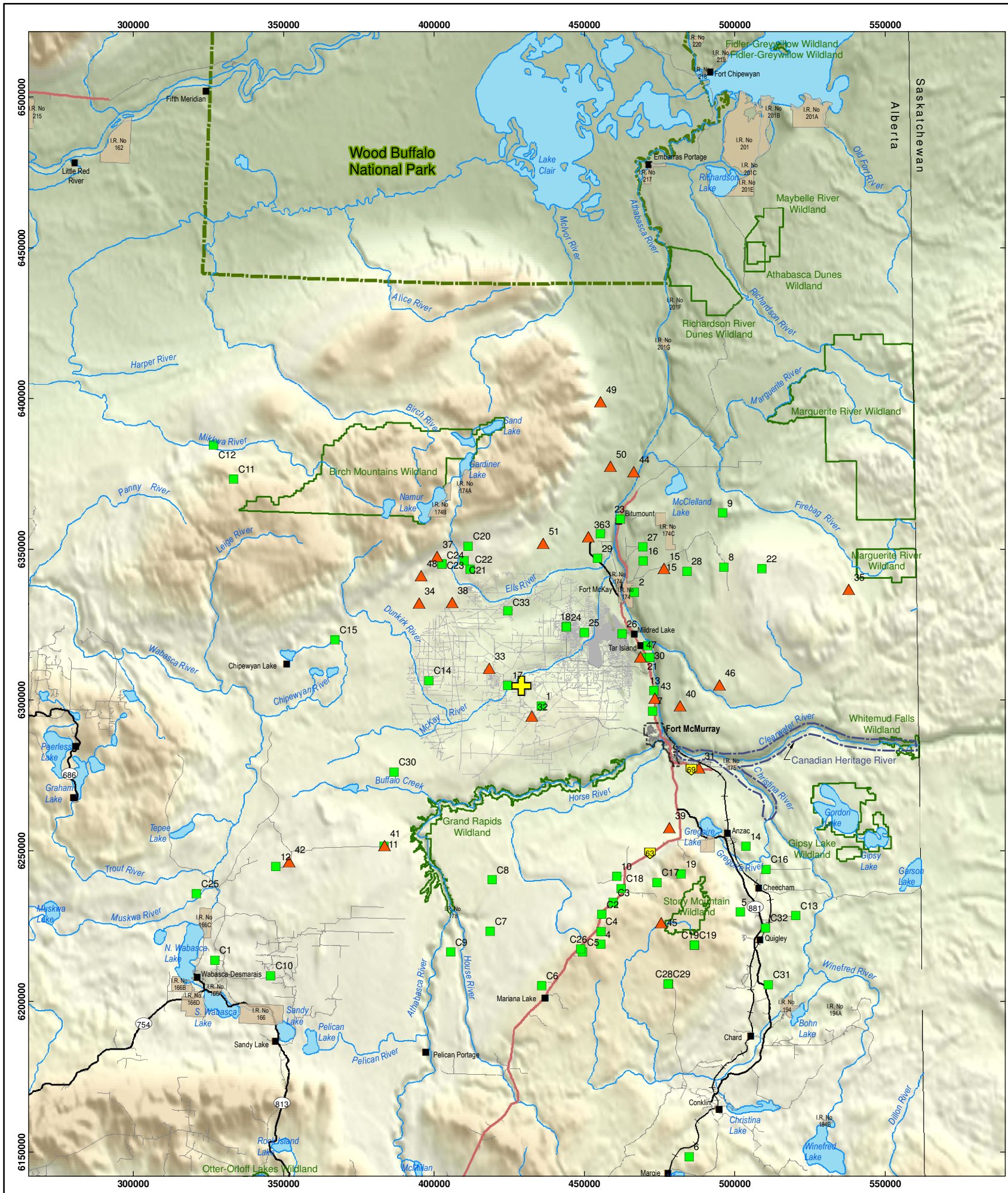
FIGURE:  
**C.2.1**



**Legend**

- Air Quality and Health RSA
  - Aquatics RSA
  - Groundwater RSA
  - Hydrology RSA
  - Soils, Vegetation and Wildlife RSA
  - Woodland Caribou RSA
  - Socio-Economic RSA (RM of Wood Buffalo)
  - Existing Phase 1 Development
  - Proposed Initial Phase 2 Development
  - Proposed Future Development
  - Indian Reserve
- Topography (masl)
- High : 800
  - Low : 200

	<b>STP McKay Thermal Project - Phase 2</b>	
	TITLE:	DRAWN: PS/SL
<b>Regional Study Areas (RSA) Used for the Environmental Impact Assessment</b>		CHECKED: KY
DATE: Nov 2/11		C.2.2
PROJECT: 10-037		FIGURE:

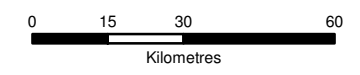


Existing and Approved Projects		
Compressor Stations		Oilsands Projects
Label	Company	Label Company Project
C1	AltaGas Services Inc.	1 Athabasca Oil Sands Corp. Mackay River Pilot
C2	AltaGas Services Inc.	2 Birch Mountain Resources Ltd. Hammerstone
C3	AltaGas Services Inc.	3 Canadian Natural Resources Ltd. Horizon
C4	AltaGas Services Inc.	4 Connacher Oil & Gas Ltd. Great Divide Oil Sands
C5	AltaGas Services Inc.	5 ConocoPhillips Canada Resources Corp. Surmont
C6	AltaGas Services Inc.	6 Enerplus Resources Fund Kirby
C7	Canadian Natural Resources Ltd.	7 E-T Energy Poplar Creek
C8	Canadian Natural Resources Ltd.	8 Husky Energy Inc. Sunrise
C9	Canadian Natural Resources Ltd.	9 Imperial Oil Resources Ventures Ltd. Kearl Lake
C10	Canadian Natural Resources Ltd.	10 Japan Canada Oil Sands Ltd. Hangingstone Pilot
C11	Canadian Natural Resources Ltd.	11 Laricina Energy Ltd. Saleski Pilot
C12	Canadian Natural Resources Ltd.	12 Laricina Energy Ltd. Germain 5K
C13	Canadian Natural Resources Ltd.	13 Northland Forest Products Ltd. Ft. McMurray Sawmill Beehive Burner
C14	Canadian Natural Resources Ltd.	14 OPTI Canada Inc./Nexen Inc. Long Lake
C15	Canadian Natural Resources Ltd.	15 Shell Canada Energy Jackpine
C16	Canadian Natural Resources Ltd.	16 Shell Albian Sands Muskeg River
C17	Devon Canada Corp.	17 Southern Pacific Resources Corp. McKay Thermal Project Phase 1
C18	Devon Canada Corp.	18 Suncor Energy Inc. Dover Demonstration
C19	Devon Canada Corp.	19 Suncor Energy Inc. Meadowcreek
C20	EnCana Oil & Gas Co. Ltd.	20 Suncor Energy Inc. Millennium/Steepbank
C21	EnCana Oil & Gas Co. Ltd.	21 Suncor Energy Inc. Voyageur
C22	EnCana Oil & Gas Co. Ltd.	22 Suncor Energy Inc. Firebag
C23	EnCana Oil & Gas Co. Ltd.	23 Suncor Energy Inc. Fort Hills
C24	EnCana Oil & Gas Co. Ltd.	24 Suncor Energy Inc. Dover
C25	Husky Energy Inc.	25 Suncor Energy Inc. Mackay River Project & Expansion
C26	Husky Oil Operations Ltd.	26 Syncrude Canada Ltd. Mildred Lake
C27	Northstar Energy Corp.	27 Syncrude Canada Ltd. Aurora North
C28	Paramount Energy Operation Corp.	28 Syncrude Canada Ltd. Aurora South
C29	Paramount Energy Operation Corp.	29 Total E&P Joslyn North Mine
C30	Paramount Energy Operation Corp.	30 Williams Energy (Canada) Inc. Fort McMurray Chemical Plant
C31	Paramount Energy Operation Corp.	
C32	Paramount Energy Operation Corp.	
C33	Paramount Energy Operation Corp.	

Planned Projects		
Label	Company	Project
31	Alberta Oil Sands Inc.	Clearwater Pilot
32	Athabasca Oil Sands Corp.	Mackay River Central
33	Athabasca Oil Sands Corp.	Mackay River North
34	Athabasca Oil Sands Corp.	Dover Pilot
35	Cenovus Energy	Borealis
36	Canadian Natural Resources Ltd.	Horizon In-Situ
37	Dover Operating Corp.	Dover North
38	Dover Operating Corp.	Dover South
39	Excelsior Energy Ltd.	Hangingstone Pilot
40	Ivanhoe Energy Inc.	Tamarack
41	Laricina Energy Ltd.	Saleski Phase 1
42	Laricina Energy Ltd.	Germain Project Expansion
43	Parsons Creek Resources	Limestone Quarry
44	Shell Canada Energy	Pierre River Mine
45	StatOil Canada	Hangingstone
46	Suncor Energy Inc.	Lewis SAGD
47	Suncor Energy Inc.	Voyageur South
48	Sunshine Oilsands Ltd.	West Elts
49	UTS Energy Corp./Teck Cominco Ltd.	Frontier Mine
50	UTS Energy Corp./Teck Cominco Ltd.	Equinox Mine
51	Value Creation Inc.	Terre de Grace

**Legend**

- Proposed McKay Thermal Project - Phase 2
- Existing or Approved Project
- Planned Project
- Human Use
- Indian Reserve
- Topography (masl)
  - High : 800
  - Low : 200



**STP McKay Thermal Project - Phase 2**

<b>TITLE:</b> Existing, Approved and Planned Projects within the Vicinity of the Proposed Project	<b>DRAWN:</b> PS	<b>FIGURE:</b> C.2.3
	<b>CHECKED:</b> KY	
	<b>DATE:</b> Sep 27/11	
	<b>PROJECT:</b> 10-037	