



**Athabasca Chipewyan First Nation and
Mikisew Cree First Nation Review of the
Phase 2 Framework Committee
Recommendations: Synthesis Report**



July, 2010



Athabasca Chipewyan First Nation and Mikisew Cree First Nation Review of the Phase 2 Framework Committee Recommendations: Synthesis Report

Prepared by:

Athabasca Chipewyan First Nation Industry Relations Corporation
Mikisew Cree First Nation Government and Industry Relations
Martin Carver, Aqua Environmental Associates
Craig Candler, The Firelight Group: Sustainable Solutions for a Shared Future
Tom Boag, Applied Aquatics Research Ltd.

On behalf of:

Athabasca Chipewyan First Nation
Mikisew Cree First Nation

Submitted to:

Pat Marriot
Alberta Environment

and

Brian Makowecki
Department of Fisheries and Oceans Canada

July, 2010



Athabasca Chipewyan First Nation
Industry Relations Corporation
110B -9816 Hardin Street
Ft. McMurray, AB T9H 4K3



Mikisew Cree First Nation
Government and Industry Relations
Suite 208, 9715 Main Street
Ft. McMurray, AB T9H 1T5

July 19, 2010

Pat Marriot
Acting District Approvals Manager
Alberta Environment
1st fl Twin Atria Building
4999-98 Avenue
Edmonton, AB T6B 2X3
T: 780-427-7033
Pat.marriott@gov.ab.ca

Brian Makowecki
Manager Oil Sand Projects
Department of Fisheries and Oceans Canada
4253-97 Street
Edmonton, AB T6E 5Y7
T: 780-495-4220
Brian.makowecki@dfo-mpo.gc.ca

Dear Sirs:

RE: Review of the Phase 2 Framework Committee Recommendations

We are pleased to submit the *Athabasca Chipewyan First Nation and Mikisew Cree First Nation Review of the Phase 2 Framework Committee Recommendations: Synthesis Report*. This report is based on the combined results of third party reviews undertaken by Aqua Environmental Associates, Firelight Group, and Applied Aquatic Research Ltd., and the preliminary results of a study of traditional use of the River, including community engagement, conducted by Firelight Group on behalf of the ACFN and MCFN. The Athabasca River is central to the identity, culture, well-being and the meaningful practice of Treaty and aboriginal rights for both ACFN and MCFN. Recent traditional use work provides evidence that these rights have been already adversely affected. The work conducted by the Phase 2 Framework Committee (P2FC) does not provide certainty to our First Nations that these rights will be sustained under future water withdrawal scenarios.

The meaningful consideration of Treaty and aboriginal rights in planning and decision-making requires properly identifying and understanding the criteria, thresholds and measures that support the meaningful exercise of these rights. In the case of the Phase 2 Framework, our synthesis report provides recommendations on developing the necessary ecological thresholds, and implementing preliminary navigation-based thresholds (ABF/AXF) to sustain the ACFN and MCFN Treaty and aboriginal rights with respect to the Lower Athabasca River. The attached synthesis report provides recommendations to Alberta and Canada on these preliminary thresholds and other steps necessary to develop a Phase 2 Framework under which the Treaty and aboriginal rights of the ACFN and MCFN would be properly considered and sustained. In addition, we provide recommendations on next steps in a meaningful consultation process.

Meaningful consultation on the Phase 2 Framework will require a full understanding of the impacts of the plan (and water withdrawals under the plan) and that appropriate actions (mitigation or accommodation) are taken to substantively address those concerns. In addition, it will require direct consultation with the ACFN and MCFN by various agencies of the Crown that have responsibility for the concerns we have identified in the synthesis report. The Federal agencies include: Department of Fisheries and Oceans (DFO), Transport Canada, Indian and Northern Affairs Canada, Parks Canada, and Health Canada. The Provincial agencies include: Alberta Environment (AENV), the Land Use Secretariat under Alberta Sustainable Resources Development, and Alberta Aboriginal Relations. We expect that DFO and AENV, as the responsible authorities on developing the Phase 2 Framework, will work with the ACFN and MCFN to ensure that these Federal and Provincial agencies are at the consultation table on these matters of concern.

We invite these agencies to meet with us so that we may share the specific results of our traditional use study reports and mapping products (which are being finalized) and to discuss the results of our review before the Phase 2 Framework is drafted.

Sincerely Yours,

<original signed by>

Melody Lepine
MCFN GIR Director

Lisa King
ACFN IRC Director

Cc.: ACFN Chief and Council
Dave Bartesko, Land Use Secretariat
Hon. Chuck Strahl, INAC Minister
Hon. Gail Shea, Department of Fisheries (DFO) Minister
Hon. Jim Prentice, Parks Canada Minister
Hon. John Baird, Transport Canada Minister
Hon. Len Webber, Alberta Aboriginal Affairs Minister
Hon. Leona Aglukq, Health Canada Minister
Hon. Mel Knight, Minister Alberta Sustainable Resources Development
Hon. Rob Renner, Minister Alberta Environment
Hon. Ron Liepert Alberta Energy
MCFN Chief and Council
Morris Seiferling, Land Use Secretariat

Disclaimer

This information is being provided to Alberta Environment and Department of Fisheries and Oceans Canada for the purposes of developing the Phase 2 Water Management Framework. Nothing in this study is meant to provide a deterministic or limiting view of the Treaty and aboriginal rights of Athabasca Chipewyan First Nation and Mikisew Cree First Nation. The information presented herein only represents what is known to the authors, through review of available materials and through preliminary results of a Athabasca River Use and Traditional Ecological Knowledge Study conducted for the purpose of informing this review.

Table of Contents

Executive Summary	ii
1.0 Introduction	1
1.1 Requirements for First Nations' Traditional Use and Treaty Rights	4
2.0 Overview of Findings from Technical Reviews	1
2.1 Hydrology, Geomorphology, Basin Context, and the Decision Framework	1
2.1.1 Background and Objectives	1
2.1.2 Issues of Concern	2
2.1.3 Key Findings	4
2.1.4 Sources of Uncertainty.....	14
2.1.5 Discussion and Scientific Recommendations.....	15
2.2 Fishes, Fish Habitat and Water Quality	18
2.2.1 Background and Objectives	18
2.2.2 Issues of Concern for Fishes and their Habitat.....	19
2.2.3 Key Findings	20
2.2.4 Sources of Uncertainty.....	22
2.2.5 Discussion and Scientific Recommendations.....	22
2.3 Traditional Use, Knowledge, Rights and Interests	26
2.3.1 Background and Objectives	26
2.3.2 Issues of Concern	26
2.3.3 Key Findings	28
2.3.4 Sources of Uncertainty.....	31
2.3.5 Discussion and Scientific Recommendations.....	33
3.0 Implications of Findings	38
3.1 Overarching Scientific Issues of Concern.....	38
3.2 Ability of First Nations to Exercise Treaty and Aboriginal Rights	41
3.3 Legal Implications of the P2FC Proposal.....	42
4.0 Recommendations to the Crown	45
5.0 Overall Recommendation.....	50
6.0 References	51
Appendix A: Recommendations Tracking Table	1
Appendix B: Information Requirements.....	1
Appendix c: Traditional Resource Use Plan	1

EXECUTIVE SUMMARY

The Mikisew Cree First Nation (MCFN) and Athabasca Chipewyan First Nation (ACFN) recognize the effort invested by the Phase Two Framework Committee (P2FC) in the development of the proposed Phase 2 water management framework (P2 Framework).

Evidence from recent community-based studies, referenced below in Section 2.3.5.1, provides a clear indication that Treaty and aboriginal rights of ACFN and MCFN members have already been affected adversely by low water levels of the Lower Athabasca River (LAR), its tributaries and in the Peace-Athabasca Delta (PAD). Further water withdrawals can be anticipated to compound these adverse effects.

This summary report draws on the findings of detailed technical reviews, jointly commissioned by ACFN and MCFN, in three areas:

- 1) hydrology, geomorphology, basin context, and the decision framework
- 2) fish(es), fish habitat and water quality, and
- 3) traditional use, knowledge, rights and interests.

These reviews identified significant unacknowledged gaps and limitations in P2FC's studies, important errors of fact, and incorrect assumptions in the models that form the foundation for the P2FC's recommendations.

Key deficiencies in the draft P2 Framework were identified, as follows:

- 1) the P2 Framework's failure to address critical issues including:
 - climate change,
 - cumulative effects on the LAR and PAD, caused from within and outside the region,
 - the loss of functionality of tributaries,
 - Treaty and aboriginal rights, including transportation and access rights, and related effects on land and water within Indian reserves and Wood Buffalo National Park,
 - provision of ecological services,
 - water quality, especially increasing levels of contaminants with decreasing flows, and
 - health of the First Nations resident in the region.
- 2) the P2 Framework's insufficient rigor in the treatment of other issues, such as
 - collection of certain key hydrologic data
 - calculation of base flows and their expected variability
 - assessment of effects over the full range of fishes present in the LAR and PAD

- stressors on the integrity of the stream channel
 - interactions between base flows and groundwater.
- 3) Lack of consultation with respect to the potential for all of the above oversights to result in infringement on ACFN and MCFN Treaty and aboriginal rights

After careful consideration, the science, and resulting recommendations regarding Option H, are found to be insufficient for protecting the ability of ACFN and MCFN to sustain the exercise of Treaty and aboriginal rights. Given the resultant uncertainty, it is recommended that Canada and Alberta not adopt the P2FC's recommendations, until measures are in place to sustain the Treaty and aboriginal rights of both First Nations today and into the future, especially with regards to related regulatory decision making for the Lower Athabasca River (LAR).

In light of these findings, it is recommended that the Crown not adopt Option H, nor any other management options recommended by the P2FC at this time.

In the absence of evident progress from the P2FC process, ACFN and MCFN have chosen to work together to begin establishing criteria, thresholds and measures associated with Athabasca water levels, and necessary to safeguard the exercise of Section 35 rights in the Athabasca region in a manner consistent with the spirit and intent of Treaty 8. Additional work is required in the P2FC and other processes to properly establish such criteria, thresholds and measures to protect the exercise of Section 35 rights (including involvement of the Crown); the proposed Aboriginal Base Flow (ABF), Aboriginal Extreme Flow (AXF) and Ecosystem Base Flow (EBF) thresholds, once refined, and in combination with robust programs of community-based monitoring and adaptive management, help fill the gaps in the recommendations of Ohlson et al. (2010.)

As a result, ACFN and MCFN request that the Crown meaningfully engage with them in a timely manner, towards a revision of the Phase 2 Lower Athabasca River Water Management Framework (P2 Framework). The measure of a successful framework will be that it fully addresses the requirements of the environment, and that it allows for the full exercise of Treaty and aboriginal rights.

1.0 INTRODUCTION

On March 1, 2007, Alberta Environment (AENV) and Department of Fisheries and Oceans (DFO) released a Water Management Framework that established a Phase 1 management system for managing water withdrawals from the Lower Athabasca River (LAR). In 2008, the multi-stakeholder Phase 2 Framework Committee (P2FC) was established to develop recommendations for a Phase 2 Water Management Framework (P2 Framework) that will prescribe when, and how much, water can be withdrawn from the Lower Athabasca River for cumulative oil sands mining water use. Athabasca Chipewyan First Nation (ACFN) and Mikisew Cree First Nation (MCFN) had concerns about the P2FC process and chose to engage with AENV and DFO through a separate parallel government-to-government process. As part of the consultation process on the P2 Framework, ACFN and MCFN are reviewing the P2FC recommendations and providing this review to AENV and DFO to inform the drafting of the P2 Framework.

This report provides the synthesized findings and recommendations from three technical analyses of the P2FC proposed water management rules for the LAR (Ohlson *et al* 2010). These studies were jointly commissioned by the Mikisew Cree First Nation (MCFN) and the Athabasca Chipewyan First Nation (ACFN). They have been carried out along three disciplinary themes: First Nations traditional use (Candler 2010), fish habitat/biology and water quality (Boag and Vander Meulen 2010) and hydrology, geomorphology, and the decision framework (Carver 2010). Each report provides further background details and rationale that support the findings summarized in Chapter 2, interpreted in Chapter 3, and for which there are composite and overall recommendations presented in Chapter 4 and 5, respectively.

Throughout this report, repeated mention is made of AENV and the DFO as the primary provincial and federal government agencies involved in the P2FC process. It is important to recognize that, while specific mention is made of AENV and DFO, the MCFN and ACFN understand that these agencies are involved in the P2FC because they are the responsible authorities representing the Crown as a whole in these matters. As such, AENV and DFO hold the full honour of the Crown for considering all potential adverse affects to Treaty rights and aboriginal rights, and not just those related to fisheries, and the environment, which are the normal purview of DFO and AENV.

The central challenge of the P2FC deliberations has been to recommend, for government regulators, the most appropriate set of water withdrawal rules for the LAR as suggested by the best science possible, and in full consideration of the implications of the rules on Treaty and aboriginal rights.

For the purposes of this submission, Treaty and aboriginal rights of ACFN and MCFN are understood to include, but are not limited to, hunting, fishing, trapping and gathering. The full practice of these rights reasonably includes, and is not limited to access to resources (such as the right to travel to preferred places to exercise those rights) of sufficient quality and quantity,

and rights of access to cultural and spiritual sites (e.g., cabins, camps and burials), according to the preferred means of the harvesters and the Aboriginal understanding of quality.

In scientific terms, the goal of maintaining full aquatic ecosystem structure and function, including maintenance of full LAR biodiversity, is commonly referred to as establishing the instream-flow need (IFN) for the river (Anderson *et al* 2006). Historically, because the IFN exercise has been applied to regulated rivers, it is often considered synonymous with establishing an Ecosystem Base Flow (EBF) – that is, the minimum flow required, in principle, in a river at all times to protect the river’s overall ecological integrity. While the focus of an IFN analysis is often on the low-flow period due to biological vulnerabilities that exist at that point in the hydrograph, the exercise includes consideration of the needs of the river during all seasons and stages of the hydrograph. For example, high-flow periods modify and maintain channel structure, adjust bedforms and mesohabitats, replenish sediment supplies, flush out sediment accumulations, and, in general, renew the channel as an aquatic environment supportive of its resident and visiting lifeforms. The formal effort to determine an IFN for the LAR is one of the first, if not the first, example of an IFN analysis carried out for a major unregulated river in Canada and as such there will be some new challenges for which there is little guidance from other work.

AENV has maintained a position that the maintenance of the aquatic ecosystem is *de facto* maintenance of Treaty and aboriginal rights (Pat Marriott, Pers. Comm.). We disagree with this position and maintain that ecosystem maintenance is a necessary, but not sufficient element of the Crown’s obligations to First Nations. We hold that the Crown is also obliged to determine, consider and respect, in consultation with the ACFN and MCFN, thresholds for use of the LAR. The first of these thresholds is an Aboriginal Base Flow (ABF) below which water withdrawals result in varying degrees of direct and cumulative impacts to Treaty and aboriginal rights. The ABF thresholds warrants restriction of water withdrawals at flows below the ABF, or adequate accommodation in the absence of an adequate ABF. The second threshold is an Aboriginal Extreme Flow (AXF) below which extreme disruption of Treaty and aboriginal rights occurs along the LAR, Peace-Athabasca Delta (PAD) and tributaries. At flows below the AXF, all water withdrawals should be stopped by the Crown, except as allowed by through full and meaningful consultation with ACFN and MCFN. The ABF and AXF thresholds are primarily relevant to ice-free periods when boat navigation is necessary for the meaningful practice of Treaty and aboriginal rights. The EBF is a complementary ecological threshold, relevant primarily to winter conditions, that indicates the limit of viability for maintaining aquatic ecosystem functions and fish populations.

A science-based IFN created specifically to protect the LAR aquatic ecosystem, combined with an ABF and AXF developed in consultation with First Nations, together, form the minimum management guidance needed to protect and maintain First Nations ability to use the Athabasca River. The IFN, in turn, has two components which must both be informed by the best science possible: weekly water management rules consistent and in combination with an EBF.

The IFN exercise, and particularly in the context of Treaty and aboriginal rights, is complicated by the fact that the Athabasca River system is undergoing a transition to a new hydrologic regime due to climate change which is expected to ultimately transform this waterbody into a river that is quite different from that of its past. The loss of headwater glaciers, the decline in snowpacks, the increase in temperatures particularly in the winter and spring, and the increase in evapotranspiration are all expected to contribute to lower freshet flows, lower low flows, and reduced mean annual discharge. These changes are already underway and the scientific and professional consensus has moved away from the debate as to whether climate change is a fact and towards adaptation (USA National Academy of Sciences 2010, p. 17; Sorocan 2009). The scientific and professional consensus is that climate change (and its effects) must be evaluated from a risk perspective. Given that Treaty and aboriginal rights are at stake in decisions regarding appropriate water withdrawals for industrial purposes, this risk assessment would enable the Crown to maintain its fiduciary obligations.

In response to the above, this review holds five overarching objectives:

1. Identify deficiencies in how the P2FC science has been framed, carried out and presented to decision makers.
2. Where deficiencies are recognized, describe additional work required to render the science and its presentation sufficient to support informed decision-making based on the best science available.
3. Identify the nature and extent of possible adverse impacts to the meaningful exercise of Treaty and aboriginal rights that may occur as a consequence of the non-consensus P2FC-recommended water extractions and provide science advice on the factors that should be considered when designing mitigation measures to address these impacts.
4. Under the proposed P2 LAR water withdrawals, describe the likelihood of causing serious or irreversible harm to the ability of First Nations to successfully exercise their Treaty and aboriginal rights.
5. Provide recommendations to federal and provincial Crown authorities on:
 - a) the minimum scientific requirements needed to support decision making that is sufficiently informed so that such requirements and recommendations can be able to protect Treaty and aboriginal rights; and,
 - b) immediate short term and long term measures needed to assure current conditions in the LAR will adequately support the exercise of Treaty and aboriginal rights.

These objectives have been addressed by carrying out three discipline-specific science reviews (physical/biological/First-Nations). This report brings together the results of the three studies and assembles and interprets the findings into recommendations for action by Crown governments.

1.1 Requirements for First Nations' Traditional Use and Treaty Rights

Over millennia, the Athabasca River has satisfied essential spiritual, cultural and physical needs of the First Nations peoples of this region, including the following:

- For both the Cree and Dene peoples of ACFN and MCFN, the river remains a defining feature, central to their lives, their economies, and their self-conception as aboriginal peoples, despite historical changes.
- Today, the LAR continues to fulfill a central role in the livelihood and culture of ACFN and MCFN.
- ACFN and MCFN harvesters have developed specialized boat-hunting technologies that are essential to the practice of their rights in respect of the LAR.
- The LAR continues to be vital to the seasonal round of the First Nations.
- It is a fundamental transportation link providing access to the PAD, river shores, adjacent lands, its tributaries and a wealth of associated resources.
- As *the* essential transportation link, it is fundamental to supporting connectivity among land use areas within the Traditional Lands of the First Nations.
- The exercise of the Treaty and aboriginal rights of the First Nations, relies heavily upon the appropriate quality, quantity and timing of water flows in the Athabasca River.

The First Nations' goal is to sustain their Treaty and aboriginal rights now and into the future, while recognizing that those rights and incidental rights have already been adversely affected.

If these rights are to be sustained, two criteria must be met.

1. A healthy ecosystem must be maintained; the LAR's health is defined, in part, in terms of the function and structure of the riverine environment; a healthy ecosystem supports more than 20 common fish living in the LAR and PAD, as well as populations of waterfowl and wildlife species living in or near the river
2. The ability to continue the use of the river, and adjoining tributaries, as the most critical transport corridor used for hunting, fishing and movement through the Traditional Lands, must be sustained. A minimum functionality of the LAR enables incidental rights (e.g., transportation) that support harvesting rights (e.g., hunting).

For the purposes of enabling the technical work carried out for this review, the above can be put into "operational" terms. For First Nations Treaty and aboriginal rights that are dependent upon the LAR to remain viable under the new P2 Framework rules, it must be demonstrated with a high degree of confidence that the following will not result:

- Adverse effects on fish and wildlife habitat and populations, including waterfowl and biodiversity, along the River and in the PAD, upon which the practice of ACFN and MCFN rights rely. Fish and wildlife of particular concern include large migratory birds (especially geese and ducks), various kinds of food fish, fur bearers (especially muskrats and beaver) and moose.
- Adverse effects on ecosystem functions and maintenance of the PAD, including ice formation and removal, upon which practice of ACFN and MCFN rights rely.
- Adverse effects on contaminant concentrations resulting from reduced dilution effect in the river and PAD, and increased risk of transmission of contaminants from tailings ponds and other facilities due to the increased number and intensity of developments relying on containment of wetted contaminants, thereby adversely affecting water quality and confidence of aboriginal land and river users in environmental quality, upon which ACFN and MCFN practice of rights, and human and ecological health, rely.
- Adverse effects on transportation and limitation of access to lands and waters through creation of impediments or barriers (e.g., mud flats, sand bars, log jams) to access related to low water levels, and upon which practice of ACFN and MCFN rights rely. This is of particular concern in side channels and tributaries to the main stream of the Athabasca River where subsistence use is reported to be most frequent.
- Adverse effects on cultural sites, cabins, burial sites, and other places upon which ACFN and MCFN rights rely. These effects may result from limited access resulting in altered use, or through physical disturbance, such as stream avulsion, and resulting erosion and instability of banks.
- Adverse effects on Indian Reserves (including lands and waters) adjacent to the Athabasca River, upon which ACFN and MCFN practice of rights rely, through creation of impediments or barriers to access, or through stream avulsion, and resulting erosion and potential removal of lands.
- Adverse effects on off-reserve traditional lands (and waters) adjacent to the Athabasca River, upon which ACFN and MCFN practice of rights rely, through creation of impediments or barriers to access, or through stream avulsion, and resulting erosion and potential removal of lands.
- Adverse effects on National Parks habitat (including lands and waters) and other protected areas adjacent to, or including portions of, the Athabasca River, and upon which ACFN and MCFN practice of rights rely, particularly due to the protected status of those lands and waters.
- Adverse effects on the quality, and annual duration, of the Athabasca River as a functional transportation corridor between Fort Chipewyan and communities south,

including Fort McKay and Fort McMurray, upon which the practice of rights, as well as important socio-economic activities of ACFN and MCFN members, rely.

While we recognize that all of these effects may reach critical levels naturally, or as a result of climate change, we have no confidence that industry water withdrawals will not contribute to and exacerbate these effects.

- The Crown's obligations in respect of the proposed P2 Framework are not solely related to the issue of aquatic ecosystem needs. There are a number of other issues which must be taken into account by the Crown in this process because they relate to or are a consequence of water flows. Unfortunately, those other issues, which are set out below, are represented poorly, or not at all, by the P2FC Report: river transportation (especially in side channels and adjoining tributaries) associated with the practice of Treaty and aboriginal rights;
- health issues (especially psycho-social factors and avoidance) related to contaminant levels (water quality and concentrations) and consumption patterns relevant to ACFN and MCFN, and the ability to access foods and practice Treaty and aboriginal rights with confidence and safety;
- land and water issues related to effects of river change on Indian Reserves adjacent to, and, including, in places, straddling the river; and
- land and water issues related to effects of river change on National Parks and other protected areas adjacent to, and, in places including, the river

The water withdrawal rules that the Crown wishes to implement must be supported by sufficient data and scientific interpretation to establish short term and long term thresholds that address the degree of scientific uncertainty present. It is important to note that, this requirement stands in contrast to AENV's perspective that maintaining a viable aquatic ecosystem is sufficient for delivering on Crown obligations toward ACFN and MCFN Treaty and aboriginal rights.

The P2FC approach is akin to conventional impact assessment and planning activities in the Alberta context. These conventional processes do not adequately analyze impacts on traditional livelihood, culture and Treaty and Aboriginal rights (e.g., ACFN IRC 2010). Key relationships among sociocultural, ecological and economic aspects that support the meaningful practice of rights need to be elucidated. For example, potential changes to plants, animals, water and air must be applied to evaluating what the change means to the traditional resource user (the direct, indirect and cumulative impact to their livelihood, their ability to teach the next generation how to exercise the right, and the ability to have places to exercise the right that are not heavily impacted by development). In addition, these changes must be examined in the context of cumulative infringements on the rights of the First Nations. Effects of existing physical disturbance, development infrastructure, access management policies, and effects related to the increased population of the LAR region, are already impacting the practice of

ACFN and MCFN rights in their traditional lands. Loss of connectivity between and fragmentation of harvesting areas is making it more difficult for ACFN and MCFN members to exercise Treaty and aboriginal rights. Without consideration of these issues, the true ability of ACFN and MCFN harvesters to exercise their rights is not assessed.

2.0 OVERVIEW OF FINDINGS FROM TECHNICAL REVIEWS

Ohlson *et al* (2010) have brought together a collection of process work and scientific studies that seek to inform the establishment of a next generation of the LAR Phase One (P1) water management rules (AENV 2007). Volume One of the P2FC report (Ohlson *et al* 2010) is a 126-page document with extensive appendices (238 pages in total) that evaluates options for management of the Athabasca River with particular reference to three key interest areas: Ecosystem Health, Traditional / Public Use, and Sustainable Economic Development. A second volume of technical appendices accompanies Ohlson *et al* (2010.)

The P2 rules conceived of by the P2FC result from selected scientific studies and reviews looking at climate change, hydrology, geomorphology, fish, fish habitat, and traditional uses. Of these issues, by far the most studied by P2FC are fish and fish-habitat issues, while the least studied issue was traditional use. Option H is the recommendation preferred by the P2FC and is the option that the P2FC recommends that AENV adopt in the P2 WMF. Option H, which was determined without consensus, has been the focus of much of the P2FC's scientific work.

The ACFN and MCFN have commissioned reviews by Carver (2010), Candler (2010) and Boag and Vander Meulen (2010), in three general areas and the findings of these technical reviews are provided in brief in this chapter. For the full details of these reviews the reader is directed to Carver (2010), Candler (2010), and Boag and Vander Meulen (2010).

2.1 Hydrology, Geomorphology, Basin Context, and the Decision Framework

2.1.1 Background and Objectives

Carver (2010) provides a review of the hydrology and geomorphology aspects of the P2FC science that have been integral to the development of the P2FC non-consensus Option H recommendation in addition to some cross-cutting/process issues associated with the decision framework and basin-level considerations. This review holds two central objectives within its subject areas and with respect to the work carried out under the auspices of the P2FC:

1. *To assess the adequacy of the scientific work for supporting the interpretations and conclusions reached, and in particular for supporting the Option H non-consensus P2FC recommendation. This includes three key questions:*

(a) is the best science available and was it employed?;

(b) where gaps are identified, what further work is required to resolve them; and

(c) has the science recognized and quantified uncertainty sufficiently to support informed decision making?

2. To identify important gaps in process associated with putting the work into a basin context, addressing uncertainty, and enabling informed and transparent decision-making.

Key source documents and information relied upon in preparing this technical review include:

- Ohlson *et al* (2010) - *Phase 2 Framework Committee Report January 2010*;
- Technical appendices included as part of Ohlson *et al* (2010):
 - Bothe and Franzin (2009): *Evaluation Criteria for Flow Alterations in the Lower Athabasca River – Channel Maintenance Flows*
 - Ghamray *et al* (2009a): *Evaluation Criteria for Connectivity of Tributaries in the Lower Athabasca River (Fletcher Channel) – Segment 1*
 - Ghamray *et al* (2009b): *Evaluation Criteria for Connectivity of Perched Basins in the Lower Athabasca River – Segment 1*
 - Lebel *et al* (2009): *Climate Change Sensitivity Analysis*;
- A collection of background reports that led to the establishment of the P2FC;
- Attendance and technical feedback at the DFO Canadian Science Advisory Secretariat meeting May 31-June 4 2010 held to prepare science advice for DFO's review of the proposed Option H rules;
- Peer-reviewed literature and government reports; and
- Personal communications including email correspondence with AENV, DFO, ACFN, MCFN, science experts, and others.

2.1.2 Issues of Concern

This review is focused on hydrologic issues, and on issues concerning the decision-making framework used by the P2FC. Past, present, and future trends in water availability are essential to the meaningful practice of Treaty and aboriginal rights because they support the aquatic ecosystem which provides traditional resources harvested by the First Nations, and because they are critical to the navigation potential of this important transportation corridor. The LAR and the PAD have complex behaviours that are affected by the changing hydrology, which in turn affects their aquatic ecosystems and their navigation potential. While the science for understanding the possible effects on hydrologic issues is very important, the process and framework for decision making are also critical for planning processes, such as the P2FC process, to reach a defensible and equitable recommendation.

Hydrologic issues of concern are associated with two main themes:

1. The general lack of available hydrologic data pertaining to:

- (a) LAR discharge at different points downstream;
 - (b) present and historic LAR tributary discharges;
 - (c) groundwater-surface water connection, and,
 - (d) to some extent, PAD hydrologic behavior; and,
2. The uncertainty surrounding future flow regimes given the reality of climate change in relation to the rapid expansion of the oilsands industry.

While there is a fifty-year flow record for the Athabasca River at Fort McMurray, there are few records publicly available further downstream. The low flows rely on the River's headwater snowfields, snowpacks, and Rocky Mountain glaciers and these have already diminished significantly due to climate change. The past cannot be considered a trusted indication of the future (Barrow and Yu 2005; Mote et al. 2005; Rood et al. 2005; Schindler and Donahue 2006). Global temperatures are on the rise. Along with them are increases in evapotranspiration and melt rates, decreases in snowpacks and longer more frequent periods of low flows in the LAR and eventually, more extreme low flow occurrences. These changes are linked to declines in ecosystem viability and in the potential for exercising aboriginal and Treaty rights through aggradation (caused by sediment deposits) and other changes in overall river morphology (Knighton 1989), declines in the efficacy of riverine habitats in supporting fish populations (Boag and Vander Meulen 2010), loss of dilution of contaminants such as polycyclic hydrocarbons (Kelly et al. 2009), and other threats to function and structure associated with strongly diminished low flows.

The LAR and the PAD are complex natural features that exist due to regional hydrologic regimes interacting with a host of geomorphologic and, increasingly, anthropogenic influences. The LAR is a sand-bed river that hosts populations of fishes and other organisms with life cycle needs that vary in relation to the river's seasonal rhythms. From the high-flow freshet to the low flows of the summer and fall to the almost six months of ice cover covering winter low flows, the annual cycle of the river depends on fluctuations in flow rates to maintain the structure of the river itself and the integrity of the aquatic ecosystem and to sustain the many goods and services (aquatic organisms, resources, navigability) it provides. As climate change alters, most likely reducing, expected seasonal water availability, and as industrial demand for water generally increases, it will become more difficult to meet these industrial demands without compromising the LAR's ability to maintain its ecological goods and services, including the satisfaction of Treaty and aboriginal rights.

Similarly, the PAD is a complex geomorphic feature that provides vast habitat in response to the seasonal rhythms of the Athabasca, Peace, and Fond du Lac Rivers, as well as a collection of smaller inflows, that are collectively largely responsible for its annual recharge. The processes that maintain the PAD's integrity are complex and are far from fully understood. Climate change changing the PAD by modifying which processes are available and where. For example, it is projected that under future climates, the ice-jam process that brings about recharge of

otherwise isolated PAD lakes (“perched basins”), will decline (Beltaos *et al.* 2006) thereby increasing the reliance on the periods of high open water to recharge perched basins.

Water withdrawals which reduce the size of the spring freshet, particularly under future climates when the spring freshet is already expected to be significantly reduced, will serve to reduce the number of lakes that are recharged in the spring. The Bennett Dam has caused extensive changes to the Peace River hydrograph which have been shown to have caused changes in the PAD, particularly in its northwest zone. Aquatic habitats decline in abundance and capacity during periods of drying (Toyra and Pietroniro 2005) leading to overall loss of PAD resilience for biodiversity maintenance and navigability. Further industrialization of the Peace River (e.g., Site C) along with water withdrawals in the Athabasca River and other anthropogenic changes create uncertainty as to whether the PAD habitats and the navigability of its river systems (and therefore First Nations’ access to traditional harvesting areas in the PAD) will be sustained into the future.

The LAR drainage system is far from pristine. With extensive development alongside the LAR and in tributary drainages upstream and downstream of Fort McMurray, this system is a partially degraded system with weakened resilience. Cumulative effects assessment of industrial development, land-use planning, water withdrawals, and proposed water withdrawals from LAR tributaries are all relevant to any comprehensive determination of appropriate oilsands water withdrawal rules.

Some of these issues and dynamics can be understood and even quantified while others are fraught with uncertainty due to data gaps, lack of scientific knowledge, and generally uncertain future trajectories resulting from climate change and anthropogenic stress. How thoroughly these uncertainties are acknowledged and quantified is critical to how appropriate a decision can be reached by the P2FC. Do the modelers and other applied scientists understand how projected changes translate into risk for important water values such as navigability and ecosystem maintenance? And where this is understood, have these uncertainties been effectively communicated to the P2FC and/or to decision makers?

2.1.3 Key Findings

(1) Climate Change

The P2FC analysis of climate change and its future effects on the LAR hydrograph underestimates both the scope of potential change and the most likely level of change for the period of oilsands development and operations.

Lebel *et al* (2009), in their *Climate Change Sensitivity Analysis* report, examine the downward pressure that climate change will have on winter and summer low flows in the LAR; however they make three analytical choices that invalidate the analysis for decision making.

The first and most significant concern is that Lebel *et al* (2009) look at only the first timeframe of projections, 2010-2039; yet available information on the water demands for oilsands

development indicate that demand will likely peak sometime in the 2040s (Golder 2005 - CEMA Surface Water Working Group, 2005, p28-29, Figure 12) and that some pit-lake infilling water demands will extend into the 2060s (Golder 2005, p.22, Table 12). In addition, Golder (2009) reports on water requirements for oil sands mining operations and indicates a sustained water demand beyond the end of the period for that study (2030), and it does not take into account water demands for pond filling or pit-lake filling at the end of operations (p.9, Figure 4, Note). Golder (2009, p.2) also comments that there are start-up delays for some development projects, and therefore the timelines will likely be extended further. It is clear from both of these sources that any consideration of climate change impacts should include potential impacts into at least the 2040s and 2050s. In contrast, Lebel *et al.* (2009, App. 2, Table 1, pp.24-25) considers only the period up to 2039, the midpoint of which is at 2025. The argument that regulations based on projections for 2010-2039 could eventually be adjusted to fit 2040-2069, as more information becomes available, shifts significant risk to potential oil sands developers. The lead times for development are significant; once the investments are made, it would be very costly to downscale or delay projects because water availability has decreased. Alberta is analyzing various bitumen production scenarios in order to inform development of the Lower Athabasca Regional Plan (LARP). The LARP will influence the economics of oil sands production and should be taken into consideration in projections upon which water allocation rules are being developed. Simply saying that the water allocation rules can be adjusted in the future if there is not enough water to satisfy oil sands demands is not adequate, without knowing, or stipulating, the likelihood that the projects, which represent massive investments, will be delayed or shut down if water is scarce.

The second concern involves the decision of the P2FC itself (Ohlson *et al* 2010, p 104) that the Climate Change subgroup not consider scenarios that were “immediately recognised as extreme hydrological changes” because they “would have significant Provincial-scale policy and management implications that would far dominate the potential implications of water withdrawals” (Ohlson et al 2010, p104). What this direction from the P2FC has done is essentially to say that climate change will be assessed as long as the assessment excludes extreme possibilities, no matter their likelihood. This is a policy bias inserted into what should be an objective scientific summation of climate change projections prepared to inform policy makers not modified by *a priori* policy choices. Hence, the results of the assessment can no longer be considered valid in indicating the range of potential hydrograph changes.

The third problem with the analysis is how the means and ranges were determined and presented by the P2FC. The mean was “eyeballed” subjectively by one of the authors (Ernst Kerkhoven, Pers. Comm.) rather than calculated based on the projections available. Furthermore, the range of projections (“variance”) was not provided to decision makers in a systematic manner nor was it applied appropriately to the other models in the sensitivity analyses. Instead, a subjective collection of outcomes was applied which may or may not be representative of the range as indicated by the Global Climate Models and the surface hydrology model. Removing subjectivity from the science is beneficial as it removes the potential for a bias in the analysis.

The above concerns can be readily addressed because the data are provided in the appendix of Lebel *et al* (2009). A logical approach might be to take the Kerkhoven (2008) flow modeling results based on climate change projections for the second period (midpoint 2055) and use a range of one standard deviation from the mean to provide a reasonable indication of the uncertainty (see Table 1). Taking into account projections of climate change in this more balanced approach would suggest a 17.0% to 47.4% reduction in annual flow and a 0.7% to 23.7% reduction in minimum winter flows over the coming few decades. Emphasis however, should likely be placed on the larger decreases in flows to be consistent with a precautionary approach, and to be consistent with the trend analysis results (Gill and Rood 2009; Burn 2009 – see below.)

Table 1. Projected flow changes for the 2050s, based on data reported in Lebel *et al.* (2009.)

Variable	Mean	Mean+1std	Mean-1std	Minimum	Maximum
Mean annual flow	-32.2 ¹	-17.0	-47.4	-54.1	-8.0
Minimum flow	-12.2 ¹	-0.7	-23.7	-28.3	9.4

¹ For comparison, the modeled change in mean annual flow for period 1 is -16.3% and for minimum flow, it is -5.8%.

The final step involves applying these more illustrative ranges to the various P2FC models. In the P2FC reporting, only some of the models have had *any* climate change analysis applied to them; for those models where projections have been applied, the projections selected are a subjective subset, creating additional uncertainty due to questions of bias and non-representativeness. Furthermore, no model has considered the implications of projected declines in mean annual flow (MAF) due to climate change which approach 50% in Table 1 for 2055. At these levels of change in MAF, precipitous declines in channel integrity and fish habitat would be expected among other effects.

It is notable that two P2FC-commissioned reports on trends in flow based on data from the past 50 years of flow records both indicate a trend of decreasing flows over time and these trends emphasize the lower end of the ranges discussed above. Gill and Rood (2009) have calculated a decreasing trend of about 0.4% per year in winter flows (~minimum flows) and a decreasing trend of 0.5% for MAF. The other trend analysis (Burn 2009) shows similar trend results when the full 50-year stream flow records are taken into account. Burn (2009) also computed trends for the last 30-year period and found that when the analysis is restricted to this more recent period, the trend in decreasing flows is much steeper. The 30-year trend for MAF is decreasing at 1.1% per year, and winter flows at 1.3% per year. Although both authors emphasize that there is no certainty that these trends will continue into the future, if these trends are projected out, Burns (2009) indicates that they would correspond to decreases in MAF of 21.3% to 35.4% at 2022, and 29.4% to 51.1% at 2037. The decreases for winter flows, based on continuing trends, would be 15.9% to 40.3% at 2022, and 21.9% to 58.6% at 2037.

The significance of the glaciers in the headwaters of the Athabasca drainage to summer/fall low flows and to MAF has not been examined by the P2FC science resulting in further uncertainty around the reliability of its projections for these important parameters. The modeling of Kerkhoven (2008), on which the projected summer/winter low flows and MAF are based, does not include glacial processes nor does it stratify the recent accelerated glacial melt from the contribution expected due to changes in snow melt and accumulation. As a result, because the model is calibrated to existing discharge records (that do not resolve glacial melt), it is possible that the model has overestimated the projected flows (including the summer low flows) due to not recognizing that there has been an embedded enhanced component within the discharge record. That component is expected to begin to sharply decline by about 2030 (Garry Clarke, Pers. Comm.) as these glaciers pass their maximum rate of disappearance. This “mixed signal” can lead to overestimates of future water availability. Demuth and Pietroniro (2001) looked at this situation in the North Saskatchewan River basin and found the minimum and mean streamflows in the North Saskatchewan River basin to already be in decline in its glaciated headwater basins.

Further analysis is needed to understand the significance of the Athabasca’s headwater glaciers on projected LAR streamflow. To date, 20-25% of glacial ice has been lost due to melt during 1985-2005 in the central Rocky Mountains (Bolch *et al* 2010). Shawn Marshall has recently calculated that these glaciers will be all gone in 83 years (Bob Sandford Pers. Comm.). To improve on estimates of longevity, Parks Canada is sponsoring a major study to determine, using Light Detection Radar (LiDAR), the volume of actual ice remaining within the Columbia Icefield system, the largest glacial system in the Canadian Rockies. Led by Mike Demuth, the results of this work will be available to be coupled to GCM projections to more reliably estimate the expected lifespan of these glaciers in relation to carbon emission scenarios. Establishing long-term water commitments to the oilsands industry in advance of receiving and applying the results of this research may result in a high level of risk to oilsands investments because additional water beyond that required for exercising Treaty and aboriginal rights may, when it is needed in the future, be unavailable.

(2) Peace-Athabasca Delta (PAD)

The limitations of the two models developed by P2FC to examine the effects of water withdrawals on the PAD are such that the utility of these models to adequately assess effects on the PAD is questionable.

Ghamray et al (2009a and 2009b) provide two evaluation criteria assessments that are essentially interesting anecdotal case studies of one particular site, rather than an assessment of connectivity of the Athabasca River to the delta lakes. They include an uncomfortable list of significant unquantified assumptions and simplifications perhaps the most concerning of all is the lack of an assessment as to the representativeness of this single site for connectivity and recharge to all sites. While the models are interesting, they cannot be considered sufficient for understanding the potential hydrologic disconnection that is likely to result in the coming decades as industrial water withdrawals and climate change intensify, in tandem.

The first Evaluation Criterion (Ghamry *et al* 2009a) describes a model constructed to investigate the extent to which Phase 2 water withdrawals would be expected to limit the connectivity to side channels and major distributaries thereby jeopardizing the maintenance of the quantity and quality of available habitat in the associated floodplains. They measured the relative change in connectivity at a single bifurcation of the Athabasca River in the delta, Fletcher Channel. “This bifurcation is but one of dozens of bifurcations in the delta each with its own particular flow regime. The Fletcher Channel represents only a limited view of the potential impacts of water withdrawals on the distributaries that may or may not be connected to Lake Athabasca in the winter.” (Ghamray *et al* 2009a.) They make no attempt to assess how representative of the PAD is this one bifurcation that they analyzed in relation to many that exist elsewhere around the delta. And as mentioned above, nor was there an attempt to consider this incremental effect under the different projected climate regimes. Furthermore, the results are interpreted in terms of a low, medium and high risk levels and yet the thresholds between these classes of risk were drawn up arbitrarily and with “there being no known data for impact thresholds” (Ghamray *et al* 2009a.) Lastly, despite a listing of many serious uncertainties and an overall rating of “high” uncertainty, they provide no confidence limits on their model outputs. Given the list of deficiencies and inadequacies of the modeling applied to this situation, it cannot be considered suitable to support informed decision making.

The second Evaluation Criterion (Ghamry *et al* 2009b) describes a model constructed to investigate the extent to which P2 water withdrawals would be expected to limit the connectivity of LAR perched basins to recharge, thereby affecting the quantity and quality of those available habitats. They use the connection to one perched basin, Big Egg Lake, as a surrogate for all the perched basins. However, the PAD can be stratified into zones in which different recharge processes are dominant (ice-jam flooding vs. high-open-water recharge) (Peters *et al*. 2006). These differences correspond, along with various factors, to variations in the elevation of the perched basins and more specifically, to sills that limit the entry of water into any given lake. Ghamray *et al* (2009b) do not gather information on lake elevations and hence are unable to link their anecdotal work to these zones of interest. While the modeling work is interesting, it is relevant to the specific spatial makeup of the site that they examined in detail; unfortunately it is not possible to generalize their results across the delta. As Ghamray *et al* (2009b) say: “The current work focuses on a single perched basin that is in close proximity to the main channels of the Athabasca where the river’s influence is expected to be maximized. Big Egg Lake is but one of hundreds of basins spread throughout the delta each with their own particular flood regime and thus represents only a limited view of the potential impacts of water withdrawals on floodplain dynamics.”

There was also no attempt made to consider this incremental effect under different projected climate regimes. Lastly, as with Ghamray (2009b), despite a listing of many serious uncertainties and an overall rating of “high” uncertainty, they provide no confidence limits on their model outputs. Given the list of deficiencies and inadequacies of the modeling applied to this situation, as it stands, it has little utility in supporting informed decision making.

(3) Channel Morphology

The approach to examining channel morphology is flawed.

Bothe *et al* (2009) examine the effects of water withdrawals on channel maintenance based on data from the Fort McMurray WSC hydrometric gauge. Rivers need periodic high flow to maintain their structure and sediment regime. These higher flows also regenerate fish habitat. Given that channel maintenance flows are generally considered the one-year or two-year flows (Wolman and Miller 1960), the approach taken is to use the flow frequency distribution from 1957-2007 and investigate the extent to which the river would be outside the range of such channel maintenance flows due to the proposed withdrawals. They define channel maintenance flows as 60% to 160% of bankfull. Because this range of flows is relatively high in comparison with the proposed water withdrawals, they conclude that the P2 rules would have no significant effect on channel maintenance. There are six elements of concern with this approach:

1. Using the 50-year flow record as an accurate representation of today's frequency distribution is inappropriate. As discussed earlier in this section, the hydrologic regime is in transition to a new state and as such it is scientifically incomplete to use this historic record without applying a correction factor reflecting the pace of climate change to date on the flow regime of the LAR.
2. Allowance is not made for further changes in the hydrograph over the lifecycle of the oilsands. As discussed earlier in this section, Lebel *et al* (2009) indicate, using a variety of analyses, that the MAF is expected to decline by one fifth to one half by the 2050s (mean of about 1/3 decline). While changes in spring peak flows are unavailable, these are expected to decline with MAF. Thus, a significant decline in spring freshet is expected and this has not been considered in Bothe *et al* (2009).
3. Confidence limits have not been provided on the results (for example due to the points one and two) nor have the assumptions been listed and the implications of these discussed.
4. The risk thresholds used, though set with reference to some observations of the Peace River, are grossly subjective and would benefit from an interdisciplinary examination that includes expertise in fluvial geomorphology and, in particular, experience with large sandbed rivers. According to the lead author of the EC, the risk thresholds are set high but, in his view, unimportant because the effect was small in practice because of the presumed large gap between the effect and the risk thresholds (Ron Bothe Pers. Comm., DFO CSAS Workshop, DATE). In our view, this level of subjectivity is unacceptable, particularly given the unknowns about the present and future flow regimes.
5. Channels are complex dynamic systems that respond to changes in flow, sediment, bank stability, anthropogenic influences (e.g., dredging) among other factors.

Examining the future condition of the LAR with a simplistic analysis likely overlooks the potential of other important factors. There are many consulting reports that have been prepared and are publicly available that should be reviewed and considered within a broader analysis that looks more comprehensively at all the factors that shape rivers and their condition and in the context of the state of the channel today.

6. No consideration is given anywhere in the P2FC science to the changes in potential riparian vegetation that may occur under projected climates (Rood et al. 2008.) These changes are of concern in relation to riparian habitats and implications for the practice of Treaty and aboriginal rights, however they may also have effect here by changing the competence of bank stability and thus have further effects on channel morphology.

In summary, while we recognize and acknowledge channel maintenance flows are less vulnerable to water withdrawals than some other channel flows (e.g., low flows), the analysis provided is incomplete in several respects. At a minimum, subjectivity should be removed, attention should be given to the actual *present* and *potential future* flow regimes, and this understanding should be used in this EC and outcome confidence limits generated. In addition, the analysis needs to be redone with guidance by a fluvial geomorphologist and recognizing a broader understanding of the controls on sandbed-river function and incorporating field knowledge of the LAR..

(4) Regional and Basin-Level Considerations

Regionally, and on a basin level, there are further issues that have not been addressed in the P2FC work.

- (a) First, water withdrawals from LAR tributaries and loss of LAR tributaries are not properly accounted for.**

The P2FC discounted as negligible the complete loss of LAR tributaries due to oilsands developments and declines in LAR tributary flows due to water withdrawals (Brian Makowecki and Ernst Kerkhoven, DFO CSAS workshop, Pers. Comm.). Yet, these basin-level changes reduce further the effective withdrawal above and beyond the Option H withdrawals being considered by the P2FC. Rather than disregard these increments, they should be inventoried and the total changed the summed, so that interested parties can reach their own conclusions about the implications, if any.

In addition, while the notion of “complete loss” may be used to evaluate the amount of water taken from LAR flows, it is meaningless when applied at the scale of the tributaries themselves. Discounting the complete loss of tributaries as “negligible” does not take into account that even a small amount of water taken from a tributary can have an affect on the tributary itself. Furthermore, it does not consider the impacts to the use of LAR tributaries for harvesting and access by ACFN and MCFN members and the impacts of these losses on the Treaty and

aboriginal rights of the First Nations. At least with respect to navigation, complete loss of tributaries is a meaningless criterion that, if applied as threshold for evaluating functionality of the LAR, would make the meaningful exercise of rights impossible. “Complete loss” does not account for water levels required for the exercise of Treaty and Aboriginal rights in LAR tributaries and the threshold for the meaningful practice of rights would be breached long before a “complete” loss came about. A criterion of “complete loss” essentially sanctions an approach to planning that says that the practice of Treaty and aboriginal rights can be reduced to virtual extinction.

Based on historic reviews of hydrometric data from the WSC stations on the LAR and on tributaries to the LAR, while winter low flows in the LAR are dominated by water originating upstream of Fort McMurray, spring freshet flows show strong increases in the proportion derived from the LAR tributaries and can exceed 50% (Doyle 1977). This observation highlights the need to fully inventory the pattern of withdrawals from these LAR tributaries.

(b) Second, no consideration has been given by the P2FC for interactions, positive or negative, between the LAR and the extensive regional groundwater withdrawals in areas adjacent to the LAR.

These should also be addressed within the basin context.

(c) Third, there are many pressures on the LAR and PAD systems - contamination, dams and diversions, extensive forest removal, groundwater mining, climate change, among others.

The P2FC does not address these combined pressures on the LAR and PAD ; new and possibly very significant declines in ecosystem structure and function will likely result, and, by implication, the ability to exercise Treaty and aboriginal rights will be impacted. The examination of the LAR should be set in the context of the entire drainage, and include the present and future contributions of the glaciers that provide a significant percentage of the summer base flow. The common approach to cumulative effects assessment (CEA) in Alberta is a project-specific impacts approach, rather than a planning/regional approach. Further, a lack of defined thresholds and lack of shared data limit the ability to conduct CEA. Notwithstanding these challenges of conducting CEA in Alberta, the issue of cumulative effects remains unacknowledged by the modelers to the P2FC and by the P2FC for decision makers.

Decision makers have raised this issue in public forums. Former Chairman of the ERCB, Neil McCrank, spoke to the need for regional assessments in his farewell speech at the University of Calgary (March 2007). The following month, Acting ERCB Chairman Brad McManus raised the same issue at a CERI conference (also in Calgary). Subsequently, Canadian Council of Ministers and Environment 2009 commissioned their report entitled “Regional Strategic Environmental Assessment in Canada: Principles and Guidance”. Plainly, regional effects are fully within the federal and provincial government’s vision and thus should be addressed better by the P2FC.

(d) Fourth, the P2FC recommendation should be examined against and aligned explicitly with other provincial land use and watershed planning initiatives.

The Lower Athabasca drainage is being assessed under the LARP and information flowing from that undertaking should be directed to the P2FC to provide a basin assessment and improve the overall strength of its recommendation. For example, Golder and Associates is preparing a climate change analysis to inform LARP (Ernst Kerkhoven Pers. Comm.). In addition, the P2FC recommendation should also be aligned explicitly with Provincial commitments under the Water For Life strategy. Finally, the Prairie Adaptation Research Centre provides climate change adaptation research services to the prairie provinces (Sauchyn and Kulshreshtha 2008). It is not clear that the Province of Alberta uses these products in guiding its policy development.

Greater transparency would be useful with respect to how the Province integrates the various procedures, commitments, and initiatives that are underway, particularly with respect to climate change.

(5) Decision-Making Framework

There are major gaps in the Structured Decision Making (SDM) process followed by the P2FC that render the SDM approach ineffective in grappling with pivotal issues present in this decision-making challenge.

Four specific gaps in the SDM process are summarized below and then explained in further detail.:

1. The Principle “Be Explicit About Uncertainty” is not met. Modeling results need to include a quantitative understanding of the level of confidence with the model outputs.
2. The principle “The best available information from all sources would be used” is not met. Significant improvements are required on some models and analyses before they can be considered the best available information (notably Lebel *et al* 2009).
3. Principle 4 in the P2FC Process Guidelines states that “the process would strive for consensus but not require a consensus recommendation among participants. Areas of consensus and non-consensus (if necessary) would be clearly documented along with the perspectives of each participating party.” Striving for consensus but not requiring it will always be problematic because decision-making discretion and accommodation remain unclear.
4. The Precautionary Principle, though implied at times, is not met. The use of the term precautionary in the P2FC discussions could give the impression to those outside these processes, especially decision-makers and the public, that the Precautionary Principle is being applied. Yet there is no clear evidence of its application in the P2FC results nor in the study report.

(6) Explicit Uncertainty

Despite the P2FC directing its subcommittees to “be explicit about uncertainty,” this principle has not been met.

Model outputs as provided to decision makers for consideration do not include confidence limits, nor an accounting -or interpretation of the combined implications of uncertainty for the outputs. No attempt has been made to propagate error in data inputs through to the model outputs nor has there been effort given to examining the compounded and interacting errors. In the P2FC’s analysis of the LAR, there is a lack of basic data on fish biology and basic fluvial geomorphology and along with extensive assumptions, other data gaps, and modeling simplifications, the confidence of modeling outputs is generally low.

Decision makers are not able to make an informed choice when they are not informed about the unstated and unquantified implications of data gaps and scientific simplifications/assumptions. Unless uncertainty is made very clear, then the science is not ready to be considered in decision making. According to the Government of Canada, “scientists and science advisors should ensure that scientific uncertainty is explicitly identified in scientific results and is communicated directly in plain language to decision makers.” The P2FC report does not do this. Instead, there is a complex suite of models each with its own limitations. Error analyses sufficient to inform decision makers of the implications of uncertainty within the models are required to remedy this. Completing these error analyses will require the participation of all the modelers to propagate the errors through the models to devise estimates that represent interactions and non-linearities within and between the models. It will also require the modeler’s professional judgments as to the implications for uncertainty of the many simplifying assumptions upon which the models have been built. This is a complex undertaking requiring the input of the entire modeling team. The Minimum Significant Increment of Change (MSIC – Ohlson *et al.* 2010, p 27) is not a replacement for an error analysis and communication of uncertainty largely because it is a subjective simplification that tends to reduce the potential for identifying uncertainty and error.

(7) Precautionary Principle

The P2FC’s non-consensus recommendation does not satisfy the precautionary principle.

The essence of the Precautionary Principle is as follows:

“When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context, the proponent of an activity, rather than the public, should bear the burden of proof. If an action poses a risk of causing harm to the environment, in the absence of scientific consensus that the action is harmful, the burden of proof that it is not harmful falls on those who advocate implementing the action.”

(<http://www.sehn.org/wing.html>).

Despite the P2FC's assertion that "Option H's 4.4m³/s EBF exemption is a precautionary approach to managing low flow events (being significantly below the assumed 16 m³/s) demand requirement" (Ohlson *et al.* 2010, p 111), there is nothing precautionary about taking water from the river at discharges down to zero. The willingness of water license holders to reduce their withdrawal voluntarily may be a *concession*, but it is not a precaution, and it cannot be regulated because it depends on voluntary measures. How can AENV ensure a precautionary approach if it cannot enforce precautionary measures? The use of the term precautionary in the P2FC and DFO discussions could give the impression that the Precautionary Principle is being applied; yet there is no clear evidence of it in the P2FC results nor in the study report from the DFO workshop of its application in the deliberations.

And lastly, we understand that AENV has acted as neutral facilitator for the P2FC process and has opted not to have representatives involved in the discussion. While it is appropriate for the provincial regulator to provide facilitation, the role of AENV does not end at this point. Neither AENV nor any other department of the Alberta Government can simply play a role akin to a "referee" or facilitator given the importance of the issue at hand. AENV must take a positive role in this process including, among other things, carrying out the legal responsibility of the Crown before making any decisions, including supporting any recommendations.

2.1.4 Sources of Uncertainty

There exists extensive sources of uncertainty throughout the analysis – explicit and implicit – about the system's hydrology and geomorphology. Many of these have not been acknowledged within the P2FC modeling work. Where they have been acknowledged, they have not been quantified nor interpreted. Thus, decision makers cannot be aware of the uncertainty (associated with the P2FC models, results and recommendations) arising from the drafting of the water management framework itself. This section provides an overview of the most problematic uncertainties is provided. A detailed accounting of the uncertainties is provided in Carver (2010).

(1) Athabasca River Hydrology (including Climate Change)

- Emission scenarios and projections from Global Climate Models combine to yield high uncertainty for the Athabasca hydrograph in the coming years, though with a strong downward trajectory.
- The 50-year average record at Fort McMurray is used as the "natural hydrograph" for all the fish and fish habitat modeling. Given that the past 50 years have shown considerable hydrograph change (with an overall downward trend, according to two P2FC studies in Lebel *et al* 2009), that 50-year average hydrograph does not represent today's hydrograph but rather something more representative of the midpoint of the period - namely, ~1985. As a result, it is likely that the modeling is consistently overestimating the current hydrograph particularly in terms of its low flows and mean annual flow. Further evidence is suggested by the fact that the lowest flows on record have occurred recently.

(2) Athabasca River Modeling

- The hydrologic model does not distinguish glacial processes and as such may be overestimating potential low flows out beyond a decade or two.
- The 2D model possesses a long list of uncertainties including not accounting for deeper late winter ice thicknesses.
- Projected changes in channel morphology due to changes in river controls, notably the estimated current and project future flood frequency distributions, remain inadequately understood and quantified.

(3) Additional Pressures on the Lower Athabasca River

- Limited information is available on groundwater and regional hydrology.
- Water withdrawals from tributaries to the LAR have not been inventoried.
- There is no analysis undertaken of the significance of cumulative effects on the LAR.

(4) Additional Pressures on the Peace-Athabasca Delta

- There is no analysis undertaken of the significance of cumulative effects on the PAD.
- No information is available as to the representativeness of the individual site considered in the two PAD ECs.

Ohlson *et al* (2010, p4) state “SDM helps people deal clearly and consistently with uncertainty, explore risk tolerance, make judgments about acceptable levels of risk and precaution, and find creative ways to manage residual risk.” As reviewed above, the lack of quantitative measures of uncertainty suggest that it would be difficult for P2FC members to deal “clearly and consistently” with the extensive uncertainties. Similarly, the relatively arbitrary risk thresholds used in many of the models would significantly limit the ability of P2FC members to comprehend the risk implications of the model outcomes, and thereby creatively manage them.

2.1.5 Discussion and Scientific Recommendations

It is globally accepted that climates are in transition (USA National Academy of Sciences 2010) toward a new regime and that the earth will be getting hotter and probably a little wetter over the coming century. The scientific debate has moved from the question of *whether* climates are changing, to defining *how fast* the climate will change in relation to potential emissions scenarios. The latest synthesis report of the Intergovernmental Panel on Climate Change (IPCC 2007) presents a range of possible emissions scenarios based largely on socioeconomic and technological factors. Although it is impossible to know what will happen decades out, it is clear that we are already exceeding the worst case (A1Fi) scenario considered by the IPCC and this emphasises the urgency in taking seriously adaptation needs around potential future climates (Figure 1.) See section 2.1.3 and Carver (2010) for further details. Through time, and incrementally, these changes will likely begin to overwhelm most of the factors considered in the P2FC analysis. In the early years, we would expect to see “depressed” flows which is what we have seen in recent years and now in 2010.

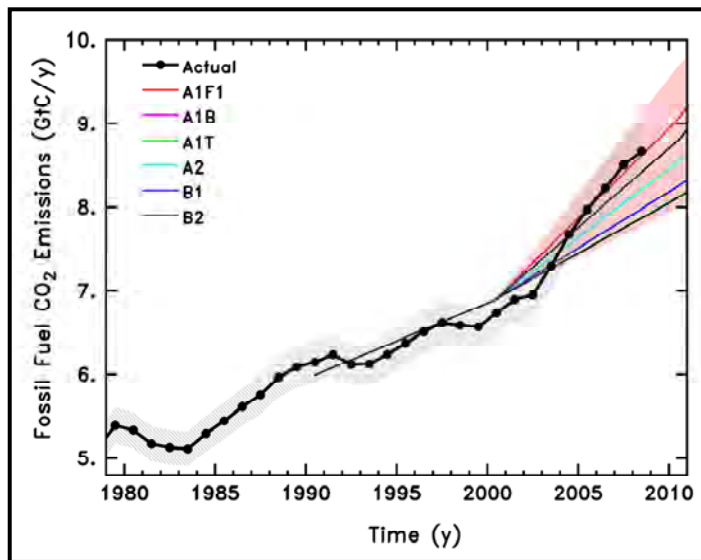


Figure 1. Actual fossil fuel emissions since 1980 compared to emission projections for various IPCC scenarios (from Allison *et al.* 2009, p.9).

The P2FC climate change and fish/fish-habitat modelling work strongly emphasises the issue of declining low flows as the primary vulnerability. While it is clear that this is the primary vulnerability in the present, as climate change deepens, all sorts of vulnerabilities are possible within the annual hydrograph. The various species spawn and rear at different times of the year and have varied needs. The opportunities for each species to successfully carry out their lifecycle needs will be challenged at various points in the hydrograph. For example, lower summer flows will cause an increase in stream temperatures, particularly in shallow side channels cut off from water inflows. An earlier breakup and a smaller peak can result in abandoned channels earlier in the summer season which might compromise travel by certain species to access key sites during their spawning periods. The interaction between hydrologic change and fish behaviour/needs has not been examined in the P2FC work.

Like other northern waterbodies, the PAD and LAR aquatic systems are already under stress due to climate change and other forms of anthropogenic change (Schindler and Smol 2006.) Hence, any reductions associated with water withdrawals will be superimposed upon an aquatic system that is already under stress due to other factors. Water withdrawals, then, will lead to a reduction in resilience of these systems to withstand the stresses that are already in place and will be unavoidably increasing. As a result, the incremental change from withdrawals, in combination with other drivers of change, will cause system change to occur earlier (e.g., side channels freezing to the bottom; higher perched lakes going dry).

Improvements in hydrologic data are required to realize improvements in knowledge about the potential effects of water withdrawals on the LAR, the PAD, and ultimately on the ability of First Nations to exercise their Treaty and aboriginal rights. RAMP holds considerable data that, if they were made available, may enable improvements in modeling and impact assessment. A hydrometric station at the mouth of the LAR is essential. Gauging along the LAR, downstream of

Fort McMurray, would enable analysis of incremental flow changes to better understand groundwater interactions with the LAR flow. With improved hydrologic data, and using all of the data that currently exist, a first order water budget for the drainage could be developed. The present work could then be put in context of that water budget.

Should a comprehensive climate change analysis remain unpursued and unapplied to the models, then an annual review of the hydrograph should be made to assess the direction of change of peak flows and lows. These annual observations should be used to identify off-stream storage requirements if an adequate precautionary flow is not put in place immediately.

The P2 rules should be developed within the context of a state-of-the-basin analysis including consideration of: cumulative effects from all human impacts, the Alberta Land-Use Framework, the basin water budget, all surface- and ground-water withdrawals for tributaries to the LAR and other areas adjacent to these rivers. Such a study would then be available to guide development of the longterm water withdrawal rules.

As improved data sets become available, it would then be appropriate to return to the many P2FC models to address non-linearities and modeling interactions and compounding effects, to ultimately propagate the modeling uncertainties through to the modeled outcomes. Only when the outcomes are provided to decision makers with plausible confidence limits will they be suitable for supporting informed decisions.

With improved information, decision makers will be in a better position to choose an informed outcome. The process followed by the P2FC, though, needs to be strengthened with real consensus decision making, defensible risk thresholds, and quantified modeling error and system uncertainty.

The PAD is a Ramsar wetland and a UNESCO world heritage site. As such, Canada and Alberta have signed international agreements that oblige them to manage these areas to protect their values. The decision-making objectives should be adjusted to reflect these commitments.

Progress on understanding channel change in response to climate change was likely hampered within the P2FC science work by the lack of expertise in fluvial geomorphology and a narrow expertise in hydrology. Future work to resolve the shortcomings of the P2FC work needs to seek out appropriate independent science expertise in these two disciplines.

In the meantime, initial steps are needed to resolve the most important gaps in hydrologic data:

- Install a winter river discharge gauge near the mouth of the PAD.
- Negotiate with RAMP to secure use of additional discharge data available on the LAR between Fort McMurray and the PAD.

- Conduct a careful annual review of the Fort McMurray hydrograph to interpret evolving trends in water availability and in relation to P1 withdrawals.

2.2 Fishes, Fish Habitat and Water Quality

2.2.1 Background and Objectives

To determine whether fishes and their habitat would be affected adversely under the proposed “Option H” regimen of industrial withdrawals, the P2FC process incorporated four Evaluation Criteria (EC) in conjunction with the River2D hydrologic model. The EC were modeled to analyze risk to aquatic resources in the LAR and the PAD in response to weekly changes in river discharge given seasonal flow and external and emerging pressures such as flow diversion and global climate change. The P2FC selected the EC through a process of elimination and best judgment which focused on practicality and the role each criterion plays in what is known of the overall ecology of the river. Each species modeled has importance in species management regionally and in province-wide sport and domestic fisheries.

The four EC modeled across the LAR include fish (longnose sucker) habitat, lake whitefish effective spawning, and walleye recruitment, plus the abundance and diversity of meso-habitat (CEMA 2009; Boag and Vander Meulen 2010). The P2FC deemed these relevant to model for the IFN because habitat suitability curves exist for each of three species and life-history stages and comprehensive mapping of fish habitat and bathymetry had been undertaken in a representative study section within each of the four river segments comprising the LAR..

This review seeks to answer three questions within its subject areas and with respect to the work carried out under the auspices of the P2FC:

1. *Is the science behind the fish biology and habitat modeling sufficient to provide confidence in an IFN for the LAR?*
2. *Is the Option H IFN sufficiently precautionary to avoid challenges to the integrity of the aquatic ecosystem in the LAR and PAD over time?*
3. *What are the consequences of the Option H IFN for fishes, their habitat and the exercise of Treaty and aboriginal rights?*

We reviewed the relevant literature provided associated with developing the fish biology metrics for the IFN (walleye recruitment, effective spawning habitat for lake whitefish), and those used to model fish habitat (longnose sucker habitat, abundance and diversity of mesohabitat). This included P2FC Appendices B, C, D and E relevant to the modeling of fishes and their habitat and past review of the original P1 IFN and flow regulation. The review also included attendance and active participation at the P2FC introductory meeting held by AENV for ACFN and MCFN in Fort McMurray (February 23, 2010), and at the Canadian Science Advisory Secretariat (CSAS) workshop held at the University of Calgary (May 30-June 4, 2010).

We provided constructive input to the P2FC IFN recommendation on behalf of the First Nations which yielded additional insight and comment on “newer” materials introduced (e.g., revised lake whitefish spawning criterion at the CSAS workshop). Use of in-house library materials, extensive professional experience sampling fish populations in the LAR, years of review of oil sand proponent Environmental Effect Assessments and their information all contributed to Boag and Vander Meulen (2010).

2.2.2 Issues of Concern for Fishes and their Habitat

The approach taken to model fish biology and habitat is reproducible and provides new tools to model fish and their habitat. While great level of effort was expended in modeling habitat in a the LAR, and should provide greater understanding of habitat, the four issues remain unresolved as discussed below.

(1) The modeling relies on extensive unquantified assumptions.

Extensive assumptions are associated with the fish biology and mesohabitat metrics modeled to conclude the IFN. The River 2-D model assumes that there exist guilds of fishes (i.e., groupings of like-sized fishes that occupy the same spaces) in the LAR. Since four of seven species were modeled in detail (a minimum of ten or more are common within the study area), it is incumbent on the P2FC to demonstrate that this is sufficient for forecasting (IFN) purposes. It remains unclear whether other fishes (i.e., those not modeled) are at risk given the lack of basic biological information available for the other common fishes and of their dynamics in the ecosystem (Boag and Vander Meulen 2010).

(2) Loss of connectivity between the PAD and LAR systems is not properly assessed.

Of concern is the potential loss of connectivity between the PAD and the channels that connect the Delta to Lake Athabasca and its effect on walleye recruitment (CEMA 2009). Ghamray *et al.* (2009a) demonstrated a clear, reproducible relationship between loss of population size with decreasing flow in the LAR and lower water level in Lake Athabasca (Paul 2009b, CEMA 2009). Since walleye rear in the PAD and either winter in the channels or in the lake proper, reduced water level in the PAD and corresponding loss of walleye production provide support that a precautionary flow is necessary at which withdrawals are cut off altogether (except for perhaps a minimal allowance of less than 1 m³/s to prevent infrastructure from freezing), to protect this species (and likely others not modeled, such as northern pike) (Boag and Vander Meulen 2010).

(3) Loss of wetted perimeter in shallower LAR habitats is not accounted for in the models.

Paul and Locke (2009a and 2009b) correlate loss of wetted perimeter with reduced flow in the LAR. They conclude that regardless of the water withdrawals associated with Option H, sufficient habitat remains to protect juvenile and adult longnose sucker –important species in the river’s food web. Loss of wetted perimeter affects fish habitat adversely in the Athabasca River since habitats less than 1-m depth are important for rearing and feeding of resident and

migratory fishes especially during early spring when water level in the river drops after local runoff and shallower, peripheral habitats warm (Boag and Vander Meulen 2010).

(4) Late winter conditions are not modeled properly.

The fish habitat criterion (Paul and Locke 2009a) and dissolved oxygen criterion (McEachern 2009) find that sufficient wintering habitat remains in each of the study sections at a mean ice thickness of 0.5 m at the IFN flow. This may be so in early winter; however the ice can be appreciably thicker (over 1.5 m) by mid-March. It is in late winter that fishes are most vulnerable to frazil ice, and reduced water quality and quantity. Consequently, wintering of fishes and the winter dissolved oxygen model should be re-run to reflect late, not mid-winter, conditions.

2.2.3 Key Findings

The four key findings that resulted from this review are discussed below.

(1) P2 models of fishes and their habitat oversimplify the complexities of fish ecology.

The River 2D Model as applied to the Athabasca River is an improvement over the original PHABSIM approach (CEMA 2009) and may be the best available approach given what we know to date of the river and its habitat (Boag and Vander Meulen 2010). Despite this improvement, the model still simplifies reality because it does not tie in the dynamic processes such as population and community effects that change with altering flow. For example, fish prefer specific habitats, not just tolerate one over another, which can affect the overall health of a population (Anderson *et al.* 2006). Improving the model by linking the dynamic processes with altered flow would require intensive data collection and would not necessarily capture the complex dynamic interactions between components of the ecosystem. Model validation data including better understanding of seasonal fish movements and interactions would be required to improve modeling predictions over time (Boag and Vander Meulen 2010).

(2) Extensive uncertainty pervades the IFN exercise.

The P2FC expresses uncertainty in the fish habitat and biology metrics through the “minimum increment of significant change.” The increment of change is a subjective surrogate or estimate of uncertainty of all assumptions and modeling error, and is intended to represent the uncertainty associated with the modeled output. The following are two specific shortcomings that need to be addressed to strengthen the predictive capability of the modeling.

(a) Lake whitefish effective spawning criterion (Paul 2009a).

The “original” lake whitefish spawning criterion model used by the P2FC up to the June-2010 DFO CSAS workshop did not include sand as suitable substrate for lake whitefish spawning. However, the revised lake whitefish effective spawning Habitat Suitability Index (HSI) includes sand as suitable substrate in the LAR (A. Paul, CSAS workshop, pers.

comm.). Sand is not a suitable substrate for whitefish effective spawning; whitefish spawn over unembedded, coarse substrate in the LAR (Boag and Vander Meulen 2010). Thus, the model overestimates the distribution of possible spawning areas for this species (and others such as walleye and longnose and white sucker) in the Athabasca River downstream from Fort McMurray. Excluding sand as a suitable substrate for spawning of lake whitefish in the Athabasca River will remedy this issue.

(b) Walleye recruitment criterion (Paul 2009b).

Juvenile walleye rear in the PAD and require access, into and out of the distributaries and perched lakes in spring and through late fall, respectively. Paul (2009b) found that “natural flow” in the LAR can influence walleye recruitment (number of walleye that reach adulthood) by up to 50%. Loss of connectivity between the PAD lakes and distributaries will be exacerbated with depressed water levels associated with a combination of factors largely driven by climate change variables (temperature, evaporation, water level in Lake Athabasca and discharge during shoulder seasons). These factors put walleye (and other species) at risk. In addition, uncertainty remains associated with the connectivity modeled and how it relates to walleye specifically, since we do not know if juvenile walleye actually winter - in the distributaries, Lake Athabasca, or both, and (if both) in what proportion.

(3) Role of groundwater on water quality not considered in P2FC science.

Groundwater may adversely influence water chemistry in portions of the river especially during periods of low flow or during repeated low flow events. It is now evident following winter dissolved oxygen sampling that depressed oxygen concentrations in the Athabasca in winter are associated with groundwater intrusion (P. McEachern, CSAS Workshop presentation, pers. comm.) The potential role of groundwater effects on water quality within the LAR need to be included in the P2FC analysis.

(4) Freezing of the river and its effect on migration and wintering of fishes is likely to be exacerbated by climate change.

Sections of channel are already less than 30 cm in depth (Segments 2 and 4) at low flow during the open water season (<300 m³/s) and will probably freeze to bottom across their width (Gerber 1989, AECOM 2009). Subsequent loss of connectivity could compromise wintering of fishes when deeper sections in the river become isolated or experience reduced flow. This loss results from reduced water quality and quantity, or during periods of frazil ice suspension causing the thalweg to seek a new way downstream when squeezed from above by ice (Gerber 1989).

The P2FC reported that loss of wetted perimeter was real during shoulder season, but less of an issue than during winter when it shrinks naturally during freeze-up. During the CSAS workshop, DFO corroborated that loss of wetted perimeter as a consequence of diversion could be deemed a harmful alteration, disruption or destruction (HADD) of fish habitat. Compromised

peripheral habitat in the LAR through loss of wetted area would reduce productive capacity through overheating (reduced depth) and/or displacement of small bodied fishes resulting in increased exposure to predation. Any HADD would require compensation under the *Fisheries Act*.

2.2.4 Sources of Uncertainty

Four sources of uncertainty in the modeling undertaken for fishes and their habitat were identified and are described below.

(1) The effect of climate change on the river's physical environment.

Uncertainty around climate change and its effect on wetted perimeter could vary appreciably based on the projections used in modeling this scenario (see section 2.1.3). Peripheral habitats and their temperature are important for fishes in the LAR – these habitats are used as movement corridors as well as summer feeding and rearing for virtually all species of fishes that reside in the LAR (NRBS 1994a; 1994b); Boag and Vander Meulen 2010)

(2) Role of groundwater recharge in the river proper.

To date, no linkage has been reported between groundwater in the upland and surface water in the LAR. Depressed dissolved oxygen concentration in the river during winter sampling contradicts this and indicates that groundwater plays a role in surface water volume in the LAR (P. McEachern, pers. comm.).

(3) Significance of ice thickness in habitat loss.

Ice thickness is underestimated in the mesohabitat model which leads to uncertainty of outcome of wintering success for fishes in the LAR (Paul and Locke 2009b.)

(4) The value of peripheral habitats.

The hydraulic model used underestimates the value of peripheral habitats because it emphasizes the thalweg and disregards side channel and tributary confluences, snyes and backwaters. Fishes generally do NOT use the thalweg; they ascend along the margins and feed in peripheral habitats in the main stem save. The exception is when they overwinter in the mainstem of the LAR.

2.2.5 Discussion and Scientific Recommendations

Decision makers must consider the merits of a project (including need), regulatory direction, policy context and scientific advice to determine whether a project is in the public interest. Unfortunately, science in natural open uncontrolled systems is rarely conclusive. This is particularly true in the present case but in addition, the uncertainty is unquantified and not well communicated – even qualitatively – to decision makers. As a result, application of the

Precautionary Principle is absolutely relevant in this instance (see section 2.1.3 for a definition of the Precautionary Principle). Given the uncertainty across the hydraulic, hydrologic and climate change models, appreciable risk exists to fishes and their habitats from mid- through late-winter. In addition, water temperatures in a shallower river are problematic because boreal fishes all experience stress with warmer water. These periods of higher water temperatures would last longer in a warmer environment and this would compromise productive capacity of the wetted perimeter in spring and summer.

Examination of EC related to fishes and their habitat is technically challenging and data-intensive, but leaves large residual uncertainty, because of lack of data and of incorporation of potentially important ecological interactions. Where there is uncertainty, the implications of any recommended regime of permitted water withdrawal will not be understood properly. It cannot be over-emphasized that the effects of allowing water withdrawal, particularly at times of low flow, are not understood fully. Notwithstanding the technical expertise applied to the examination of EC, uncertainty remains (all of it unquantified) and it can be resolved only by further data collection, modeling, and involvement in basic science that deals with the complexities of the ecology of such a large changing system.

Paul and Locke (2009a and b) discuss explicitly the assumptions and uncertainties associated with the fish habitat criterion. What should be emphasized is that uncertainties at each stage of the P2FC process may be compounded (additively or multiplicatively) and it remains unclear how this affects predictions regarding water withdrawal, particularly at low flows. The modeled outcome for each of the metrics analyzed depend on Habitat Suitability Curves (HSC) curves that are derived from expert opinion and sparse data. Whereas the assumption is explicit, it does introduce uncertainty that render conclusions less reliable. These curves are a useful starting point, but require validation.

Professional judgment is the primary basis for most of the risk thresholds assigned. These limits remain unsatisfactory surrogates for understanding which ecological interactions matter most and what the quantitative nature of these interactions is. Water withdrawal regimes were examined for their predicted effect on loss of habitat during sensitive life-history stages for the species examined. Unfortunately, percentage losses in habitat were compared to somewhat arbitrary guidelines that do not recognize inherent ecological complexities. For example, for periods when habitat is likely to be limiting already, nothing but “no loss” can be considered negligible, while a non-zero loss less than 10% may result in a reversible population decline, and a 10+% loss would likely cause a decline that might be irreversible. In general, the risk thresholds do not reflect these limitations and hence could be misleading to decision makers. We argue that these thresholds are arbitrary in the P2FC – boundary assignments influence the prediction of “fate” of the population at risk as described above. Further, even if the professional judgements were acceptable, they are meaningless where there are major issues with modeling methodology, uncertainties and the simplistic approach to the risk assessment.

The mesohabitat criterion explores how flow might affect broad habitat types defined by water depth, water velocity, and substrate type as output from the River2D hydraulic model (Paul and

Locke 2009b). Preservation of mesohabitat diversity should result in maintenance of associated biotic diversity and dynamics. In essence the same criticism applies as for fish habitat evaluation: ecological complexities are masked over and important interactions ignored. Considerable field validation and data collection is required to address uncertainty regarding the results of the evaluation.

Validation of current HSC curves is of paramount importance recognizing that collecting such data, particularly where telemetry is involved, is challenging. It is acknowledged, for example, that mechanistic information regarding basic ecological interactions is lacking such as competition and predation and their potential effects on walleye recruitment (Paul 2009b).

Wherever uncertainties and assumptions are recognized in EC related to fishes and their habitat (Paul 2009a,b; Paul and Locke 2009a,b), the respective analyses continue with the best data currently available. Assumptions require validation through further data collection, but in the absence of such information, a formal analysis of the magnitude of compounding uncertainty is critical. At this time the manner and amount in which uncertainty increases through successive steps of modeling and examination of EC are unknown. Regardless, the fish biology EC and habitat metrics modeled reflect sufficient concern to warrant a precautionary approach to prevent adverse longterm effects to fish populations, especially those in the PAD (Boag and Vander Meulen 2010).

Only a single criterion related to water quality was studied as part of the P2FC process. Dissolved oxygen concentration (DOC) in wintering habitat was modeled as a function of flow. The model found DOC not to be affected appreciably by changes in discharge (McEachern 2009). Other water quality parameters were not considered. For example, the effect of reduced capacity for dilution of increasing pollutants given a regime of increased water withdrawal and decreased flow was not assessed.

Until now, there has been a general understanding that mineable oil sands operations result in large surface disturbances (e.g., tailings ponds and overburden dumps) on the land. Given that these features are all located within the LAR's watershed, the potential for these sources of pollutants to pollute the Athabasca River might seem obvious. Tailings ponds are constructed with sand dikes that are designed to leak, not seal. Overburden dumps contain high sodic materials that eventually will migrate down slope. These features will require maintenance for a long time, given the risk to the LAR and further downstream, if they fail.

Potential sources of pollutants are relevant to consideration of IFN because development and the risk for release increase while increased water withdrawal reduce the capacity for any dilution. Despite efforts to avoid releases they will occur and the frequency will increase with further development which means that the absolute amount of pollutants released will increase. However, water withdrawal implies less volume of water to dilute pollutants and possible increased concentrations of certain substances. A common approach in environmental impact assessments is to model projected concentrations of substances of concern and compare results to guidelines for water quality. No such consideration was given in the current process for establishing an IFN.

As yet, cross-lease and regional approaches to reconstruction of surface drainage on the landscape appear to be absent. Instead, long straight trenches are being approved along lease boundaries. No consideration is evident with respect to re-establishing a normalized pattern of surface to groundwater recharge and groundwater to surface discharge.

The other major source of risk comes from the processing plants and pipelines. Spills, leaks, fires, explosions, equipment malfunctions, pipeline breaks, excessive emissions and other “upset conditions” have become part of the accepted norm.

Given the expected increases in both disturbance features and process upsets, some work has been undertaken to document the current “baseline”. The initial conclusions are that oil sands development does contribute to pollution of the Athabasca River (e.g., Kelly *et al.* 2009). The next modeling challenge will be to assess increased stressors and decreased flows against water quality and biota. It seems intuitive that the directionality of those model outputs will indicate further stress, unless the landscape features are reduced in size and number, and the plant processing controls are improved.

As a result of these findings, the following needs are identified for monitoring and adaptive management:

1. Baseline data collection.

HSC curves need to be validated for each species and guild relative to the mesohabitat modeled usable area. The P2FC needs to validate assumptions that longnose sucker juveniles share the same habitat in the LAR as white sucker juveniles, lake chub, trout perch, and flathead chub, for example. Numerically, the small-bodied and forage fish guilds are most abundant in terms of their contribution to species richness. Consequently, as a minimum, a subset of these species is important to provide some assurance that the River2D model outputs are reproducible across the forage fish guild (including young coarse fishes).

2. Walleye use of the PAD.

Use of PAD distributaries during winter by walleye (and others) needs to be confirmed. Importance of perched basin lakes for fish production needs to be quantified as does the nature and extent of fish habitat present.

3. Assumption of winter ice thickness.

Ice thickness varies in the LAR from under 0.5 m to over 2 m in some locations. The IFN has been derived on an expectation of 0.5 m as being a typical ice thickness in the river during winter. We believe this measure over represents winter river habitat. This needs to be addressed by repeating the mesohabitat model with what habitat across the various segments is more restricted, during late winter when the ice thickness is typically 0.75 - 1.0

m. Running the model under more extreme conditions (e.g., 1.5 m of ice) would be illustrative of the risk associated with less frequent weather conditions. As with all models, the results need to be validated through a monitoring program, with subsequent adjustments in the assumptions and descriptions of the model's uncertainty.

2.3 Traditional Use, Knowledge, Rights and Interests

2.3.1 Background and Objectives

The scope of this review includes comment on the application of good social science practice, the adequacy of methods and documentation, and the level of consideration given to ACFN and MCFN use, knowledge, rights and interests within Ohlson *et al* (2010) and its associated recommendations. It does not consider nor provide comments related to any Aboriginal communities or organizations other than the ACFN and MCFN.

Key source documents, and information relied upon in preparing this technical review include:

- Ohlson *et al* (2010) and its associated appendices, dated January 2010, and accessed in PDF form from the P2FC website at <http://compassrm.com/AthabascaWPlan/logon.asp>;
- Information and documents, including email correspondence, provided by ACFN and MCFN staff members to the Firelight Group for review; and,
- A series of interviews with ACFN and MCFN elders and river users conducted by the Firelight Group in Fort McMurray and Fort Chipewyan in May 2010 which form the basis of the ACFN and MCFN Athabasca River Use and Traditional Ecological Knowledge Study summarized below.

Issues of public use, traditional use and navigation are reflected in Ohlson *et al* (2010) section 5.4. Appendices include Appendix D: Comparing water withdrawal alternatives' effect on traditional use, a *Memorandum submitted to the Socio-Economic Task Group* (Westland 2009a) (5 pages in total), and the supporting Westland Resources Group report *Impact Hypothesis Analysis: Effects of Water Withdrawal on Traditional Use of the Lower Athabasca River* (Westland 2009c) (58 pages in total), provided as a technical appendix in Volume Two of the P2FC report. Supplementary information provided by CEMA as of July 08, 2010, was also reviewed.

2.3.2 Issues of Concern

The importance of the Athabasca River to the practice of past, current, and planned future practice of Section 35 Treaty and aboriginal rights by ACFN and MCFN members cannot be overstated. Like salmon or cedar on the west coast, available information suggests that the

water of the Athabasca River and delta plays a central role in defining the way of life, livelihood, and cultural identity of the Athabasca Chipewyan and Mikisew Cree peoples.

ACFN and MCFN community members have already expressed a very high level of concern regarding existing disruption of the quality, quantity and timing of flow of water in the Athabasca River. Through interviews of ACFN and MCFN elders and expert river users the following key issues were identified. This is not a complete list:

- Concern regarding the loss and degradation of the Athabasca River as a resource essential to the practice of rights under Treaty No. 8.
- Concern regarding declining fish and wildlife habitat and populations, including waterfowl, along the Athabasca River, and particularly in the delta area. Elders and expert river users link this to low water levels on the Athabasca River and its tributaries and the continued drying in the PAD.
- Concern that low water levels create barriers to boat travel (e.g., mud flats, sand bars, log jams), particularly into side channels and up smaller rivers near where they join the LAR. The tributaries (including the Richardson, Firebag, Embarras and others) are, in many cases, the only mode of access available to ACFN and MCFN members into important land use areas. Boat travel, especially up LAR tributaries and PAD tributaries, is necessary for subsistence hunting and other activities within ACFN and MCFN traditional lands, including travel to Fort McKay and Fort McMurray. At a minimum, there must be sufficient flow to allow the rights-holder to access a particular area (LAR, tributaries, for example) as well as to transport whatever is being hunted, fished, trapped, or gathered.
- Concern regarding effects on ecosystem function and delta maintenance, including ice formation and related spring flooding (including removal of log jams) and vegetation changes, including transition from grass and herbaceous plant species to willow shrubs along river edges and into the delta, where these affect traditional use and access to traditional lands
- Concern regarding contamination of waters and declining water quality, including frequent indications of avoidance of traditional resources (including fish, moose, and medicines) in the Athabasca River watershed due to psychosocial factors (Health Canada 2005) associated with proximity to oil sands and related contaminants. Increased number and intensity of developments will result in increased containment of wetted contaminants (within tailings ponds, dedicated disposal areas, and overburden dumps), thereby increasing risk to water quality. As each new approval further and reduces the communities' confidence in environmental quality, an overly simplistic Phase 2 Framework will likely make this issue worse.
- Adverse effects on, or in the vicinity of, cultural sites, cabins, burial sites, and other places, as well as on distributed, quality-specific interests (aesthetics, privacy, sense of place, values

attributed to pristine landscapes) that are important to practice of cultural and spiritual values.

2.3.3 Key Findings

With regard to potential effects on Treaty and aboriginal rights, knowledge, and interests including navigational interests, this review finds that, while some aspects of Ohlson *et al* (2010) are adequately considered (particularly the recognition that intergenerational traditional knowledge transfer is vulnerable to river change), the report is, overall, inadequate and misleading, and should not be relied upon to inform regulatory decision making.

The report contains a series of serious deficiencies, including inappropriate assumptions, definitive yet unsupported findings, errors of fact, inadequate statement of limitations, highly problematic omissions, inadequate documentation of methods, and inconsistencies in analysis suggestive of poor and unreliable research design. At least eight major flaws in the P2FC report and its treatment of Treaty and aboriginal rights, knowledge, and interests have been identified.

1. **No mention or consideration of Treaty and aboriginal rights, nor any consideration of the incidental rights of the First Nations to access areas to practice Treaty and aboriginal rights**
2. **No recognition of the main limitation of the P2FC process with regard to First Nations interests.**

Key First Nations, including ACFN and MCFN, chose not to participate in the P2FC process based on concerns, expressed to the Crown, regarding the P2FC process itself, and instead chose to participate in alternative and parallel government-to-government processes. The lack of mention of these alternative processes obscures the limits and gaps of the P2FC process; making such gaps and limits visible to decision makers was one of the guiding principles of the process. While the perspectives of the P2FC report are importantly limited with respect to the First Nations interests they represent, this limitation was not expressed in the report.

3. **The primary analytic documents relied upon by the P2FC to evaluate potential effects regarding First Nations and Aboriginal use overstate the validity of the analysis.**

The Westland (2009c) Impact Hypothesis Analysis indicates that their work: “should not be considered complete, but rather a representative sample of the knowledge possessed by people in the aboriginal communities of the study area” (Westland 2009c:41). Given that the majority of First Nations in the study area did not participate in the Westland study, there is no evidence of a systematic method for sampling or interviewing in any of the P2FC documents reviewed. A representative sample is, by definition, carefully designed to represent a population as a whole, and so it is difficult to understand how statement in the Westland (2009c) report could be true. The statement implies either a lack of familiarity with basic social science concepts, a misunderstanding of the aboriginal communities of the study area, a

serious misrepresentation of the underlying data that supports the P2FC recommendations regarding aboriginal use, or a lack of care in presenting limited evidence.

4. The P2FC material considers six impact hypotheses related to First Nations use, but supporting methodological material provided by CEEMA (an excerpt from Westland 2009c) indicates only five impact hypotheses were evaluated, at least in interviews with community members.

Despite little indication of evidence and documentation of a clear method for analysis, the Westland (2009c) report definitively rejects three of its six hypotheses as not being vulnerable to water level change: *“Traditional use of nearby rivers, traditional diet and health of Aboriginal people, and spiritually important areas are not considered to be sensitive to water withdrawal, and need not be considered in the examination of flow management”* (Westland 2009c:42). Nor were there any reliable measures, criteria or thresholds employed to understand what is needed to exercise Treaty and aboriginal rights (including the rights incidental to the exercise of harvesting rights). Rejection of these hypotheses is not consistent with available public information, nor with preliminary results from interviews with ACFN and MCFN elders and river users. .

5. Section 8 of the P2FC report provides a detailed performance assessment of Option H, the non-consensus recommended option, however there is no indication that Treaty and aboriginal rights or use were among the factors considered in evaluating the suitability of Option H.

6. Within the P2FC material in general, there is widespread inconsistency regarding what the various hypotheses actually mean, resulting in confused and misleading analysis.

In the example likely of greatest consequence, a major disconnect is apparent between the evidence contained within the Impact Hypothesis Report (Westland 2009c), the hypotheses tested in that report, and the resulting findings of Ohlson et al (2010) that dismiss ‘Traditional use of nearby rivers’ as not vulnerable to water withdrawals. The initial form of this hypothesis in the Westland 2009c report is, “water withdrawal contributes to decreased ability to use rivers close to the mainstem of the LAR for traditional Aboriginal purposes” (Westland 2009c:22), however the resulting analysis of the hypothesis (pp. 22-26) does not address ‘decreased ability to use’, but instead evaluates whether or not aboriginal use (and non-aboriginal use) will be displaced from the Athabasca River to other nearby rivers, resulting in increased traditional use pressure on rivers such as the Clearwater. While the analysis and evidence are more appropriate to a recreational-use study, the result is a finding of ‘limited’ effect, and Westland (2009c) rejects the hypothesis of increased ‘traditional use of nearby rivers’. Ohlson et al (2010) then restate the hypothesis in its original form, and this misguided analysis removes from further consideration what is possibly the most important consequence of water withdrawals for aboriginal use: decreased ability to use rivers flowing into the main stream of the Athabasca River for traditional Aboriginal purposes.

7. No hypotheses dealing with the influence of withdrawals on water quality and perceptions of water quality were tested.

This is highly surprising given:

- the level of concern regarding environmental contaminants and aboriginal health in communities in the region and nationally;
- that even perceived contaminant risk can have enormous effects on the practice of Treaty and aboriginal rights; and,
- the amount of water in a river system is at least as important as the amount of chemicals going into it in determining the dilution or concentration of those chemicals.

This is a serious omission. Based on interviews with ACFN and MCFN elders and expert river users, it is clear that perceived contaminant risk and related psycho-social factors (Health Canada 2005) are already a major factor affecting aboriginal use in the Athabasca River region (see 2.3.5.1 below). Immediate attention and resourcing of community-based monitoring is required to address this problem. Water quality issues should not be omitted from P2FC consideration nor from regulatory decision making with regard to water withdrawals.

8. The assessment of navigation is based on an incomplete 2D model and inappropriate assumptions.

Section 5.4.2 of Ohlson et al (2010) provides the results of an assessment of navigation based on an incomplete 2D model and assumptions that, while they may be appropriate to jet boats traveling the main stem of the Athabasca River, are irrelevant to the issue of navigation for subsistence purposes. AECOM's (2009) examination of navigation is based on an assumption that: "When water depth exceeds 0.6m, it is anticipated that most recreational craft will be able to navigate the river unabated" (p.7). A depth of 0.6 m equals approximately two feet. Interviews with ACFN and MCFN land users indicate that, assuming an outboard motor (the standard used by subsistence users on the river), and a fully loaded boat (as after a successful hunt, or in outfitting a cabin for the winter), the minimum safe depth needed for operations (including start-up and getting 'on step') is approximately 4 feet. Interviews also indicate that the areas most critical for subsistence navigation are off the main channel of the river, including side channels, behind islands, and up smaller tributaries that adjoin the Athabasca River. None of these areas was addressed in the AECOM (2009) analysis as it was focused on whether or not there was an available route through the main channel, assuming a depth of 0.6m as fully navigable.

Barriers to navigation due to water level are of particular concern to ACFN and MCFN. The most significant, and most common barriers occur at places where tributaries join the Athabasca River. When these blockages occur, large expanses of traditional lands can become inaccessible by boat, and thus unavailable for the practice of rights. ACFN and MCFN have conducted preliminary research based on a systematic mapping and interview method, and with a small sample of elders and expert river users. This work is summarized in 2.3.5.1 below. In reference to navigation and the AECOM (2009) study, Westland (2009c) notes: “the sections of the river for which navigability modeling was completed do not include areas where tributaries enter the main stem of the Athabasca River” (p. 14).

2.3.4 Sources of Uncertainty

Main limitations, sources of uncertainty, and missing information include the following:

1. The fact that key First Nations, including ACFN and MCFN, chose not to participate in the P2FC process is not acknowledged.

ACFN and MCFN expressed concerns to the Crown, regarding the P2FC process and chose to engage in a parallel government-to-government process rather than participate in the P2FC.. The resulting information gap is not acknowledged in Ohlson et al (2010).

2. Methods for data collection and criteria, measures and thresholds for analysis are unclear, or not present.

This gap results in considerable uncertainty regarding the validity of what little evidence is presented in the P2FC reports and supporting documents regarding First Nations traditional use and interests.

3. Major issues, including effects of water withdrawals on water quality, meaningful exercise of Treaty and aboriginal rights, effects of river change on reserve lands, and effects of water level on navigation for subsistence purposes are not typically addressed.

As noted above, in the case of First Nations use of tributaries, when a First Nation issue was addressed, irrelevant information was applied. Then the issue was discarded from any further consideration.

4. Models for, and assumptions regarding, navigability are inadequate to address subsistence use.

5. There is a lack of information regarding cumulative infringements on the Treaty and aboriginal rights of ACFN and MCFN.

As discussed earlier in Section 1, conventional impact assessment and planning processes do not adequately analyze impacts on Treaty and aboriginal rights. Effects of existing physical disturbance, development infrastructure, access management policies, and effects related to the increased population of the LAR region, are already impacting the practice of ACFN and MCFN rights in their traditional lands. Loss of connectivity between and fragmentation of harvesting areas is making it more difficult for ACFN and MCFN members to exercise Treaty and aboriginal rights. Without consideration of these issues, the true ability of ACFN and MCFN harvesters to exercise their rights is not assessed.

A regional consideration of cumulative infringements on Treaty and aboriginal rights of ACFN and MCFN is required to fill information gaps regarding, for example: the overall impact to traditional livelihood; the ability of rights-holders to teach younger generations how to exercise the right; the amount and suitability (from an aboriginal perspective) of lands available and accessible to exercise the rights; and, the amount and suitability of resources available and accessible to support the exercise of rights. Such a study should be based on quality environmental and social science, and completed under the direction of the communities involved. It should consider the effects of the P2 Framework in combination with other projects such as the proposed construction of the 'Site C' project on the Peace River system.

6. The effects of changes to plants, animals and fish in riparian areas and tributaries, and the possible impacts to Treaty and aboriginal rights, is not examined.

There is inadequate information regarding riparian vegetation change and wildlife and fisheries change related to LAR riparian areas and tributaries, particularly related to culturally important species upon which the practice of Treaty and aboriginal rights depends (e.g., muskrat, beaver, moose, various medicine plants, and waterfowl).

Effects of water withdrawals on traditional resources must be examined in order to evaluate the potential and actual impacts on the Treaty and aboriginal rights of ACFN and MCFN.

7. There is no consideration of the effects of water quality on the health, well-being and practice of Treaty and aboriginal rights of First Nations.

Additional work related to health, diet, practice of rights, and avoidance patterns related to contaminants, as well as identification of priority solutions, is needed. This work should be considered within a wider context of cultural and environmental effects related to the Athabasca River region.

8. More information is needed on how cultural resilience can be supported.

Additional study of how transmission of cultural knowledge can be supported in the face of avoidance areas related to water quality or water level is needed, including

identification of specific obstacles to traditional knowledge transfer and prioritized ways of overcoming them, supported by, and developed in consultation with, First Nations.

9. More information is required on how Treaty and aboriginal rights related to the LAR may be adversely affected under water withdrawal scenarios.

A comprehensive regional planning-level study of Treaty and aboriginal rights, and traditional knowledge, in respect to the LAR basin is required. This study should include lands and waters where access may be influenced by LAR water flow changes. It should also examine and assess the underlying quality and quantity of resources needed for the meaningful exercise of Treaty and aboriginal rights.

A corresponding operational level study, complementary to the comprehensive study, should also be completed. This would include documentation and annual community-based monitoring of cultural and spiritual values along the LAR, including habitations, trails, subsistence areas, and quality or species specific values.

2.3.5 Discussion and Scientific Recommendations

With regard to potential effects on Treaty and aboriginal rights the January 2010 report of the P2FC (Ohlson *et al* 2010) is inadequate and misleading, and should not be relied upon to inform the P2 Framework and subsequent regulatory decision-making. Correcting this would require, at a minimum:

1. additional community-based field work;
2. reliably designed and executed community and social science based studies;
3. completion of a reliable subsistence navigation analysis based on appropriate assumptions and relevant stretches of river; and,
4. a conceptual approach that recognizes that the Treaty and aboriginal rights of the First Nations are constitutionally protected and can only be adversely impacted or infringed under strict conditions outlined by the courts.

In regard to each of these requirements, ACFN and MCFN have already made significant progress working together and outside of the P2FC process through a jointly initiated project entitled Athabasca River Use and Traditional Ecological Knowledge Study. While results are based on only a small sample of MCFN and ACFN elders and river users, and analysis is still underway, preliminary findings from this work are summarized below; these are very relevant to addressing some of the key gaps in Ohlson *et al* (2010) and supporting documents, including the establishment of thresholds relevant to Treaty and aboriginal rights as practiced on the LAR. MCFN and ACFN would like to share confidential information from these studies, which is relevant to the P2 Framework, with the Crown. MCFN and ACFN request that Alberta establish

a confidential government-to-government table to facilitate this sharing of information and to establishing a meaningful process for implementing a P2 framework in keeping with the spirit and intent of Treaty No. 8.

2.3.5.1 ACFN and MCFN Athabasca River Use and Traditional Ecological Knowledge Study: Summary of Preliminary Findings

The ACFN and MCFN Athabasca River Use and Traditional Ecological Knowledge Study was established to document detailed community use, knowledge, and issues related to the Athabasca River. To inform the P2FC review, the study was completed within a compressed time frame and on a limited budget.

Thirteen MCFN elders and frequent river users and fourteen ACFN elders and frequent river users were interviewed for the study in May 2010. Interviews were conducted with individual participants, included documentation of prior informed consent, and used a standardized interview guide designed to meet the needs of the study and provide a consistent framework for soliciting and recording responses. Spatial data were collected using standardized map coding on custom 1: 50,000 maps with acetate overlays. Interviews were recorded with a digital audio recorder, and thorough interview notes were captured on the interview forms, or in a note book. Questions were designed to gain an understanding of perceived river change, and to collect data that was location specific (point, line, or polygon) and temporally grounded (season and year was recorded where possible). The study was designed so that disaggregation of community data (MCFN or ACFN) and individual participant data is possible.

Each interview consisted of three sections. The first focused on the participant's experiences on the river, observed changes in the river, or observed changes in the community's relationship with the river. The second section focused on how water levels and water quality have affected the participant's use of traditional lands and resources. The third section involved mapping individual's experiences on the river with regard to navigation and observed changes in the river's quality and flow. Particular attention was paid to mapping areas where access becomes limited at low water levels. The standard of transportation specified in interviews, and on which responses were based, was a fully loaded boat, as after a successful hunt, or outfitting a trapping cabin, with an outboard motor. Based on interview responses, and later verification, the safe navigational depth (including start-up) in such a scenario is approximately four feet (1.2m).

After preliminary analysis and synthesis of the information gathered, community engagement meetings were held in Fort Chipewyan in early July. One meeting was held with the MCFN Traditional Knowledge Committee, one meeting was held with ACFN Elders and interview participants, and an open ACFN community meeting was held. At these meetings information on the preliminary study results, as well as information on the P2 Framework and P2FC recommendations were presented for community consideration and input.

The final report is anticipated to be completed in coming weeks. Based on preliminary analysis, ACFN and MCFN study participants provided, and mapped, more than 150 independent accounts of streams, lakes, and areas of the Athabasca River that are accessible and used for

the practice of Treaty and aboriginal rights, but that become inaccessible at low or very low water.

ACFN and MCFN participants reported and mapped approximately 45 specific instances where the exercise of specific aboriginal and Treaty rights (hunting, fishing, trapping, and others) by ACFN or MCFN members has been avoided, or impeded, due to low or extremely low water levels in the Athabasca. Examples of these include inability to use cabins and associated trap lines due to low water, or choosing not to shoot a moose or other animal because water levels would not allow transport of meat.

Participants also provided numerous specific and mapped instances where ACFN and MCFN members avoided traditional resource use (including hunting, fishing, and plant or medicine collection) because of concerns regarding Athabasca River water or environmental quality, and industrial contamination. Examples include specific instances of abandoning moose meat on the land because of problems noticed in the meat or organs, or fish caught and thrown back in the river due to perceived quality issues.

Major streams and waterways accessed by ACFN or MCFN members for the practice of Treaty and aboriginal rights, but reported to become inaccessible at low and very low water include, but are not limited to:

- Richardson River, which becomes inaccessible at low water near where it joins the Athabasca River, resulting in lost or limited access to territories, including cabins and trap lines, within a large area frequently referred to as the Richardson Backcountry.
- Jackfish Creek, which becomes inaccessible at low water near where it joins Richardson Lake, resulting in lost access to hunting, fishing, and cultural sites, including burials, located within IR Chipewyan 201E.
- Richardson (Jackfish) Lake itself, located within IR Chipewyan 201E, and constituting the majority of its area, which becomes inaccessible at low flow levels at its outlet into Jackfish Creek resulting in lost access to very important hunting, fishing, and cultural sites located within IR Chipewyan 201E.
- Various waterways in the delta, including within Indian Reserves (particularly IRs Chipewyan 201, 201B, 201C, 201D, and 201E) and extensive areas of Wood Buffalo National Park, including Lake Claire and surrounding area (see Mamawi Lake) become inaccessible at low flow levels.
- Mamawi Lake which becomes inaccessible at very low flow levels and in several places resulting in loss of access to a very large territory within Wood Buffalo National Park, including Lake Claire, Birch River and McIvor River, and which contains numerous cabins and trapping areas, still currently used, as well as very important hunting and subsistence areas, and cultural sites.
- Numerous side channels of the Athabasca River itself become inaccessible at low flows resulting in lost or impeded access to cabins, trap lines, important hunting areas, and

other values, including areas within IR Old Fort 217, IR Chipewyan201F, and IR Chipewyan 201G.

- Firebag River, which becomes inaccessible at low flow levels where it joins the main stream of the Athabasca resulting in loss of access to hunting areas and other values.
- Other tributaries to the Athabasca, including Muskeg River, Ells River, and Dover/McKay Rivers.

In combination with additional baseline studies, monitoring and adaptive management related to First Nations knowledge, use, rights and interests should be implemented, regardless of what water management option is chosen. This should include community-based programs led and controlled by community leadership and informed by quality social and environmental monitoring and science techniques.

2.3.5.2 Defining an Aboriginal Base Flow (ABF) and Aboriginal Extreme Flow (AXF)

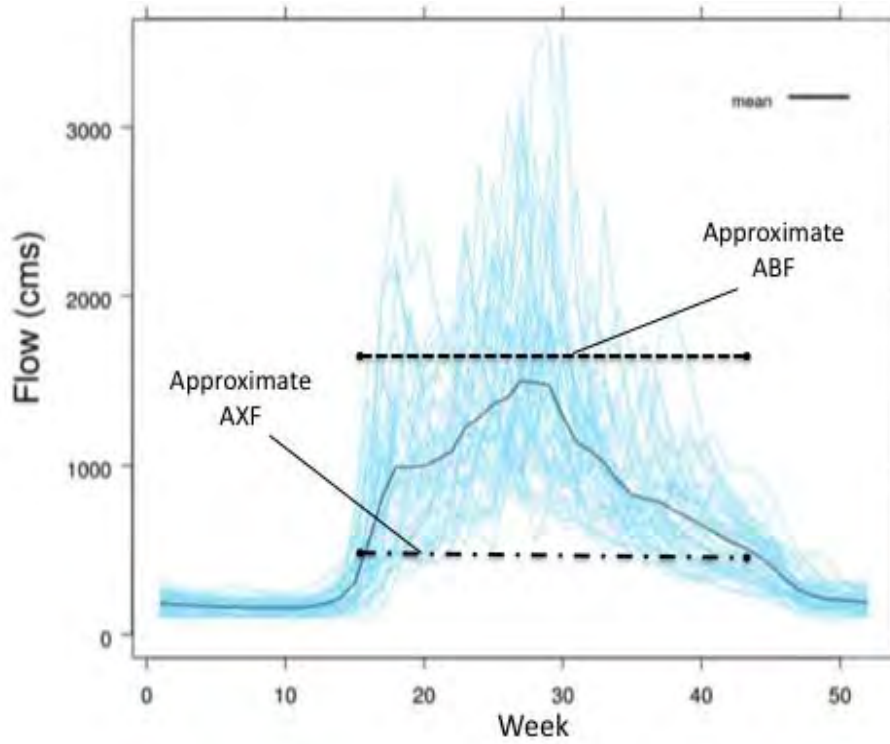
Preliminary results of the ACFN and MCFN Athabasca River Use and Traditional Ecological Knowledge Study suggest that the threshold for impacts to Treaty and aboriginal rights vis-à-vis flow rates is two tiered. The preliminary thresholds described below were derived from comparing results of interviews to the LAR hydrograph. Details on methods will be provided in the final report for the ACFN and MCFN Athabasca River Use and Traditional Ecological Knowledge Study. ACFN and MCFN invite the Crown to meet with them so that ACFN and MCFN may share further detailed information from that study.

According to preliminary results, at flow rates below approximately 400 m³/s, widespread and extreme disruption of Treaty and aboriginal rights occurs along the Athabasca river, delta, and tributaries. While elders indicate the practice of rights in the delta has already been irreversibly impacted due to the Bennett Dam and resulting drying of the delta, establishing an Aboriginal Extreme Flow (AXF) threshold at 400m³/s would serve as an initial measure to address the further erosion of treaty and Aboriginal rights on the LAR, and to inform monitoring and adaptive management.

Preliminary results also suggest that above approximately 1600 m³/s (a high 'normal' spring-summer level), that Treaty and aboriginal rights with regard to navigation, access and water level may be practiced fully along the LAR and adjoining tributaries. This reflects a level that, according to ACFN and MCFN members interviewed, allows safe passage (approximately four feet or 1.2m of water) throughout the Athabasca River. This Aboriginal Base Flow (ABF) threshold of approximately 1600 m³/s should be established as a companion threshold to the AXF.

At flow rates between the ABF and AXF, varying levels of adverse effects to aboriginal use and rights occur due to water levels. The levels currently set for both the ABF and AXF are preliminary thresholds and may be refined through additional work. Figure 3 provides a visual depiction of the preliminary thresholds.

Figure 2. Athabasca River hydrograph showing approximate Aboriginal Base Flow (ABF) and Aboriginal Extreme Flow (AXF) thresholds.



3.0 IMPLICATIONS OF FINDINGS

3.1 Overarching Scientific Issues of Concern

As a result of this review, several overarching scientific concerns regarding the P2FC materials are apparent and are listed below. Tremendous uncertainty and enormity of ecological risk results from changing river conditions over time under a valid range of climate change and water withdrawal scenarios; these issues of uncertainty and risk, give the intent to use the P2FC work as the basis for policy decisions and water allocations cannot be overstated. The current P2FC work provides only a start to the scientific work that is required to support informed decision making.

1. **Weak and missing principles undermine the P2FC process.**

The Structured Decision Making approach pursued by the P2FC has been undermined by weak or missing principles. The considerable uncertainty surrounding the modeling predictions, while mentioned, has not been quantified and thus is not “explicitly recognized” in the process. As a result, this gap may mislead policy and decision makers by implying scientific conclusiveness where it doesn’t exist. The principle of “consensus” has been inappropriately operationalised so that it is, in practice, ineffectual. A wealth of other knowledge and data sourcing techniques exists that would have enabled the models to have been more effective; unfortunately, this “best available information” was not pursued and thus this principle has not been met.

2. **The scientific context is skewed towards fish habitat modeling with too little emphasis on hydrologic, geomorphologic and traditional-use issues in addition to a lack of appropriate data and analysis support.**

Open northern river systems such as the LAR, undergoing an ongoing climate transition and under tremendous anthropogenic stress, are highly dynamic and complex systems. This complexity and dynamism makes these systems inherently “uncertain,” difficult to study and extremely difficult to model with good confidence in the outputs. The LAR system is a complex interaction of hydrologic, geomorphologic, and climatic systems that in turn support the aquatic and riparian ecosystems; these complex features provide ecological conditions and services that support the practice of Treaty and aboriginal rights (which themselves are part of a complex system involving ecological, sociocultural and economic components). The science work of the P2FC has been focused on fish habitat modeling, at the expense of assessing hydrologic and geomorphologic issues and current information on navigation and other elements of traditional use that are vulnerable to water withdrawals.

This lack of scientific balance is aggravated further by not putting the LAR science in the context of a basin analysis which would consider the full range of concerns including other water withdrawals, dams and diversions, contamination, other land-use pressures such as forest removal, cumulative effects analysis, and, of course, a plausible climate change analysis including consideration of glacial loss. Also, this scientific work sits in an unrecognized policy

context that includes the LARP and the Water for Life Strategy. The P2FC work should be nested explicitly within and linked to these larger processes/mandates.

Modeling of these multiple, complex, dynamic and interacting systems is not adequately supported scientifically by essential data and supporting analyses. Most models that have been developed suffer from a lack of validation data, so while the models are, at times, quite involved, the modelers are unable to provide the accuracy of the outcomes nor the representativeness of their sites. In addition, with respect to the fishes, the P2FC relies heavily on the guild concept applied to the LAR – it is unclear whether from a sport and domestic fishery perspective that the other species have been adequately considered. And perhaps most importantly, the potential scope of climate change and its implications during the lifespan of the oilsands have been downplayed by an assessment that lacks rigour (see below).

Much could have been learned by complementing the modeling with such observations of integrated system behaviour particularly given that the LAR hydrograph appears to be undergoing considerable change from its past behaviour. While there is an opportunity to examine in detail the interactions of the present P1 rules (now 2-3 years in place) in relation to known gauge results, known spatialised water withdrawals, and available experience from First Nations of their river use as they attempt to exercise their Treaty and aboriginal rights, this has not been completed to inform the P2FC work.

3. The tremendous uncertainty involved with the P2FC scientific work is not quantified thus weakening the valid use of the science to inform policy decisions.

The P2FC's understanding of the LAR system, its aquatic ecosystem, and traditional-use dynamics, in relation to projected water withdrawals under a changing climate is characterized by a tremendous breadth and depth of uncertainty, which is of critical importance to regulators' ability to manage immediate and future ecological and economic risks in the LAR area. This uncertainty arises from a lack of knowledge, data deficits, the narrow science context (see above), a skewed science emphasis, and a lack of rigour in propagating known uncertainties and measurement errors through models to determine the confidence limits on modeled outcomes. In turn, these modeled outcomes have been interpreted according to simplistic single-parameter risk thresholds that have, in a number of instances, been arbitrarily assigned. While the P2FC work clearly names many uncertainties, it fails to quantify them. Given that uncertainty has not been addressed, it is difficult to understand how policy is being developed based on the best science available.

Uncertainty is not only a science-to-policy concern but also presents a science-to-decision-making difficulty. Because the large uncertainties associated with the P2FC science are not quantified, it is challenging for decision makers and others who need to use the science to interpret these results appropriately. Models, while useful for policy makers to explore possible future outcomes, are not accurate representations of actual future realities, i.e. model results are not *facts*, but *predictions*. When scientists do not explicitly and rigorously explain how scientific uncertainty is treated in their analyses, decision-makers may accept scientific analyses of environmental problems as being more *factual* than the model can justify.

If the scientific understanding of the LAR system was thorough, issues of uncertainty may not be problematic to policy making because the modeling outcomes might inherently have narrow confidence limits (i.e., it would be more likely that the models are “accurate” predictions of future realities and that policy makers could be more confident in the model results). As mentioned earlier, however, the LAR system (and the interacting systems that comprise the LAR and/or depend upon the LAR) are inherently uncertain and difficult to model with confidence. It is highly likely that if the uncertainty with the models were quantified in all cases, including interaction and compounding uncertainties, the confidence limits would be so wide as to render the scientific results/recommendations essentially irrelevant for decision making. When there is a lack of understanding of scientific uncertainty, decision-makers should take a precautionary approach.

4. The P2FC non-consensus Option H does not reflect a precautionary approach.

While the P2FC uses precautionary language, the recommended Option H is not based on a precautionary approach. The Government of Canada holds that “[T]he application of precaution is a legitimate and distinctive decision-making approach within risk management” (GoC 2003.) The P2FC committee appears not to understand the concepts of precautionary given that it states (Ohlson et al 2010, p 111) “Option H’s 4.4m³/s EBF exemption is a precautionary approach to managing low flow events (being significantly below the assumed 16 m³/s) demand requirement.” The willingness of water license holders to reduce their withdrawal voluntarily may be a *concession*, but it is not a precaution. Regardless of the lack of application of the precautionary principle, it is well recognized that a modern decision making process must be informed by an appropriate assessment of “consequent risks.”

5. The Climate Change Analysis is of critical importance to all other P2FC analyses but its utility is limited by an inappropriate time-frame.

The single greatest analytical concern with the P2FC science is its climate change analysis. Projections are based on an inappropriate timeframe, and the range and means are determined with policy intervention and unnecessary subjectivity. Due to the overarching downward pressure of climate change for most LAR values of importance, this one analysis has implications for all of the analyses. And some models, notwithstanding their other limitations, have not been considered under future climates, at all.

6. Overall the lack of balance in the P2FC work leaves many questions unanswered and limits the utility of this work for valid policy making.

In summary, the P2FC science has been out of balance:

- too much emphasis on modeling
- not enough emphasis on obtaining validation data;
- good mention of uncertainties

- little-to-no effort expended in quantifying or interpreting those uncertainties meaningfully for decision makers.

In addition, the focus of the underlying premise of the P2FC committee (to prescribe water withdrawals for oil sands development) biases assumptions that inform the science work.

Overall, enormous questions remain that have not been addressed. While the science can be built upon, it is not ready to support policy making around major future water withdrawal rules. The extreme level of uncertainty and risks present for the aquatic ecosystem and the ability of First Nations to exercise their Treaty and aboriginal rights underlines the need for caution and consultation.

3.2 Ability of First Nations to Exercise Treaty and Aboriginal Rights

Adverse effects from the P2 Framework are anticipated for:

- fish and wildlife habitat and populations, including waterfowl, along the River and in the PAD, upon which practice of ACFN and MCFN Treaty and aboriginal rights rely;
- ecosystem functions and delta maintenance, particular in segment 1 (the delta), including ice formation and removal, upon which practice of ACFN and MCFN Treaty and aboriginal rights rely;
- contaminant concentrations resulting from reduced dilution effect in the river and PAD, and increased risk of transmissions from tailings ponds and other facilities due to the increased number and intensity of developments relying on containment of wetted contaminants, thereby adversely affecting water quality and confidence in environmental quality, upon which practice of Treaty and aboriginal rights, and human and ecological health, of ACFN and MCFN rely;
- transportation and limitation of access to lands and waters through creation of impediments or barriers (e.g., mud flats, sand bars, log jams) to access related to low water levels, and upon which practice of ACFN and MCFN Treaty and aboriginal rights rely, and particularly in side channels and tributaries to the main stream of the Athabasca River where subsistence use is most frequent;
- cultural sites, cabins, burial sites and other places and values through limited access resulting in altered use, or through stream avulsion, and resulting erosion and instability of banks, and upon which ACFN and MCFN Treaty and aboriginal rights rely;
- Indian Reserves and other traditional and legally held lands adjacent to the Athabasca River, upon which ACFN and MCFN practice of Treaty and aboriginal rights rely, through creation of impediments or barriers to access, or through stream avulsion, and resulting erosion and potential removal of lands;

- National Parks habitats (including lands and waters) and other protected areas adjacent to, or including portions of, the Athabasca River, and upon which ACFN and MCFN practice of Treaty and aboriginal rights rely, particularly due to the protected status of those lands and waters; and
- quality, and annual duration, of the main stream of the Athabasca River as a functional transportation corridor between Fort Chipewyan and communities south, including Ft . McKay and Fort McMurray, upon which the practice of Treaty and aboriginal rights, as well as the economic viability of the Fort Chipewyan region, ACFN and MCFN, and areas of the Northwest Territories, rely;

ACFN and MCFN call on the Crown to meaningfully, deeply, and directly consult regarding its consideration of the P2FC non-consensus recommendations, and the P2 Framework, and the establishment of a companion P2 Consultation and Accommodation framework that will apply to future water licenses on the LAR.

In our view, further water allocations from the LAR risk effects on water quality, quantity, fisheries, waterfowl, big game, lands adjacent to the LAR, navigation, transportation, and access to traditional lands. These lands include lands under Federal jurisdiction (Wood Buffalo National Park, Indian Reserve lands). These issues are the responsibility of multiple departments from Canada and Alberta. Federal consideration of ACFN and MCFN issues with respect to the P2 Framework must involve not only DFO, but also Health Canada, Transport Canada, Indian and Northern Affairs Canada, and Parks Canada. Provincial consideration of ACFN and MCFN issues with respect to the P2 Framework must involve not only AENV but also Sustainable Resource Development, Aboriginal Relations and Energy. Consultation must include these departments to ensure that ACFN and MCFN issues and concerns are adequately understood and addressed.

We call on the Crown to establish an adequately funded and timely process for confirming the recommended ABF and AXF, implementing a process for community based monitoring in support of the ABF and AXF, and negotiation of a consistent approach for determining warranted accommodation and consultation on a government-to-government basis.

3.3 Legal Implications of the P2FC Proposal

Section 9.4.4 of the P2FC report, dealing with implementation, makes clear the intent to enact the P2 management rules as an Approved Water Management Plan under the Water Act, and to adopt these rules in the LARP, both of which would then have legal status. In acting honourably, the Crown's P2 Framework and LARP must be developed in a manner that takes full account of Treaty 8 and the attendant Treaty and aboriginal of ACFN and MCFN. Information provided by the First Nations in this report, as well as in meetings and correspondence sent to the Governments of Canada and Alberta in numerous other processes, clearly demonstrates the importance of the Athabasca River and its tributaries to the meaningful practice of the Treaty and aboriginal protected by section 35 of the *Constitution*

Act, 1982. That information, together with other information showing adverse impacts and infringements to those Treaty and aboriginal rights (such as that contained in Section 2.3.5.1), considered together with further impact and infringement that any approved P2 framework is likely to create, clearly triggers a duty to consult.

As such, it is of concern that, to date, neither Canada nor Alberta have adequately and meaningfully consulted the First Nations nor taken measures to seek to accommodate their Treaty and aboriginal rights. Giving the two First Nations the ability to have input into this process is only the first step in consultation. The Crown and the First Nations must work together to understand the concerns raised herein and to find ways of seriously considering and substantially addressing those concerns. Placing the rights of the First Nations into a consensus form of decision making, with attendant trade offs, is insufficient to discharge the honour and duty of the Crown, particularly when the Crown continues to avoid taking steps (as called for in numerous processes by MCFN and ACFN) to develop criteria, thresholds and measures to ensure the meaningful practice of Treaty and aboriginal rights now and in the future.

The failure of the Crown to take these steps is troubling and surprising, since Treaty 8 expressly sets out, at a minimum, the rights to hunt, fish, and trap, which are constitutionally protected. Those rights, in turn, depend on the resolution of issues related to the IFN for the Athabasca River, as well as the impacts of any such decisions on nearby streams and tributaries in which the First Nations exercise their Treaty and aboriginal rights. Hunting, fishing, trapping and gathering are all dependent to varying degrees on water quality and quantity, yet the exercise of those rights is not meaningfully addressed in the P2FC Review.

The First Nations have raised in several different processes (such as P2 Framework parallel government-to-government process, Land Use Framework and LARP, project-specific applications), the need for consultation related to the following:

- criteria, thresholds and measures necessary for the meaningful exercise of Treaty and aboriginal rights now and into the future;
- the need for further study (and funding) to better assess resource and ecosystem needs, such as through a Traditional Resource Use Plan and collection of meaningful baseline information; and,
- the need to properly assess the potential direct and cumulative impacts of development (including water-related needs) on the ability of the First Nations to exercise their Treaty and aboriginal rights.

Unfortunately, there remain no recognized criteria, thresholds and measures necessary for the exercise of Treaty and aboriginal rights nor has funding been provided, nor a commitment made, by either level of government to work with the First Nations to carry out the kind of studies set out above. There is no legal impediment to doing these things, simply a lack of political will to do so.

Absent this critical information, it is difficult to know how either level of government can make informed decisions on the needs of the First Nations related to IFN and how the legal duty of the Crown to consult and, if required, accommodate First Nations can be met.

4.0 RECOMMENDATIONS TO THE CROWN

ACFN and MCFN now call on the Crown:

(1) To implement the ABF, AXF, and EBF thresholds.

- Immediately establish, resource and implement, a tripartite (Federal, First Nation, Provincial) table consisting of First Nations leadership and statutory decision makers from the Crown, all with clear mandates to negotiate a P2 consultation and accommodation framework as a priority companion to the P2 water management framework;
- Engage ACFN and MCFN at the tripartite table so that ACFN and MCFN can share existing or newly assembled confidential information including the traditional use study results and maps, collected in establishing their recommended ABF, AXF, and EBF.
- Negotiate direct accommodation measures for the effects of past water withdrawals by industry upon ACFN and MCFN Treaty and aboriginal rights over the duration of the Phase 1 framework.
- Negotiate establishment of a mutually agreeable process for determining accommodation for water withdrawals that have adverse effect upon ACFN and MCFN Treaty and aboriginal rights over the duration of the Phase 2 framework.
- Jointly with ACFN and MCFN, implement evidence-based ABF, AXF, and EBF frameworks on the Athabasca River before Dec. 31, 2010. If this cannot be achieved, precautionary thresholds should be set and implemented along with a timeline for completion of evidence-based rules.
- Work with First Nations to develop additional thresholds, criteria, and measures to assess potential impacts on Treaty and aboriginal rights using a Traditional Resource Use Plan model.

(2) To take steps immediately to prevent further harm.

- Update how the P1 rules are applied by determining an up-to-date historic average hydrograph based on data to 2009, not to 2004 as it is now.
- Suspend the permitting of new mines and the issuance of all water licenses in the region that have the potential to cause further harm to the Athabasca River.
- Slow down the renewal of water permits of existing mines so as to lower and cap the peak water withdrawal that will be needed by the oilsands industry from the LAR.

- Establish a temporary precautionary (cutoff) flow of 100 m³/s at the Fort McMurray hydrometric station until a science-based EBF can be determined. When the flow at Fort McMurray drops below this precautionary threshold, allow no withdrawals except possibly minimal withdrawals (a total of less than 1 m³/s) to prevent freezing.
- Establish a temporary precautionary ABF at a level of 1600 m³/s, and a temporary precautionary AXF at a level of 400 m³/s.
- Apply the precautionary principle in adjudicating all future oilsands mining water licence applications.
- Review existing water allocations against current use and consider whether these allocations are still appropriate.

(3) To initiate a program of studies to refine and improve the ABF, AXF and EBF.

Address scientific and knowledge gaps to determine the appropriate IFN including the EBF, AXF and ABF:

- Determine an ongoing interim precautionary flow based on the likely current 1/100 year low flow incorporating our best understanding of the current flow regime as modified by climate change to date. Engage independent outside climate change experts to help establish the current flow expectation corresponding to this return period.
- Conduct field studies to address data gaps, including data regarding tributaries, and including refinement of navigable limits of streams adjoining the Athabasca, as well as confirming evidence based ABF and AXF numbers on the river, and using flow models.
- Address inadequate information regarding riparian vegetation change and wildlife and fisheries change related to riparian areas and streams adjacent to the Athabasca River, particularly related to culturally important species upon which the practice of Treaty and aboriginal rights depends (e.g., muskrat, beaver, moose, various medicine plants, and waterfowl).
- Revise models to address deficiencies and incorporate the additional field data promptly as they become available.
- Update the Northern Rivers Basin Study and apply many of the recommendations made in regards to the Athabasca River.
- Propagate error through the models and risk assessment to quantify aggregate uncertainty.
- Present results to decision makers (including First Nations) along with defensible risk thresholds and clearly expressed confidence limits of the modeled outcomes.

- Make arrangements to have all data (e.g., RAMP data) available for use in this scientific work.
- Install a hydrometric station near the a) Athabasca mouth and b) in the boundary between Segment 3 and 4, or in an alternate location agreed to by the parties. Secure resources to ensure that data are reported year-round and on a minimum weekly basis during the ice-covered period. This station needs to be “transparent” so that stakeholders can ensure that proponents are compliant with commitments relative to their licence allocation for water withdrawal.
- Acquire the flow data for all gauges on the Athabasca and use these data to improve knowledge of the basin water budget.
- Calibrate and validate models over the coming year.
- Quantify error and propagate through the P2FC models by establishing the confidence level associated with each input parameter of each model used in building the Phase 2 options.
- Provide the modeled outputs, complete with quantitative confidence limits and the additional qualitative assumptions that accompany each metric.

(4) To interpret the LAR science within the context of a basin analysis.

- Engage an independent expert on climate change projections to develop a credible analysis of likely future climates. Use these projections to determine the corresponding changes in LAR mean annual flow, winter low flow, summer low flow, and spring peak flow. Propagate these hydrologic results, as appropriate, through each corresponding and relevant Evaluation Criteria model. (See section 2.1.3 for further information.)
- Integrate findings from the LARP into a complete climate change analysis to develop a full suite of plausible climate-change LAR flow projections out to 2070 for use in model sensitivity analyses and informed decision-making.
- Conduct a basin analysis, set the LAR in the context of the wider regional issues, including consideration of cumulative effects from all human impacts, the Alberta Land-Use Framework, the basin water budget, and all surface- and ground-water withdrawals for tributaries to the LAR and in other areas adjacent to these rivers, with a focus on Treaty and aboriginal rights of First Nations.
- Undertake a rights-based analysis that ensures that the appended information requirements (Appendix B) are answered and that a Traditional Resource Use Plan is developed (Appendix C).

- Quantify other withdrawals and pressures as well as oilsands-related withdrawals, as well as forest, wetland and muskeg removal, to further understand the cumulative impacts to the Athabasca River.

(5) To develop a Management Plan to Assist in Considering Traditional Knowledge and Use in Resource and Land Use Planning and Decision Making

- Support the development of a Traditional Resource Use Plan consisting of a comprehensive regional planning level study of aboriginal knowledge, use, Treaty and aboriginal related to the Athabasca River and adjoining watersheds, and focusing on the underlying resources needed for the meaningful practice of Treaty and aboriginal rights. Developing this plan would require that the types of studies detailed below would be completed.
- Undertake, with ACFN and MCFN, a regional cumulative effects assessment on the Treaty and aboriginal rights of CFN and MCFN. Such a study should be based on quality environmental and social science, and completed under the direction of the communities involved. It should consider the effects of the P2 Framework in combination with other projects such as the proposed construction of the 'Site C' project on the Peace River system.
- Resource additional First Nations-directed work related to health, diet, practice of Treaty and aboriginal rights, and avoidance patterns related to contaminants, as well as identification of priority solutions, as needed. This work should be considered within a wider context of cultural and environmental effects related to the Athabasca River region, and should take into account a capacity building approach to psychosocial effects consistent with Health Canada advice documents (Health Canada 2005).
- Resource additional quality work, directed by First Nations, of how transmission of cultural knowledge can be supported in the face of avoidance areas related to water quality or water level including identification of specific obstacles to traditional knowledge transfer the best ways of overcoming these obstacles, supported by, and developed in consultation with, First Nations.
- Conduct a corresponding operational level study of Treaty and aboriginal rights and traditional knowledge, including detailed community-based documentation and annual monitoring of cultural and spiritual values along the Athabasca River itself, including habitations, trails, subsistence areas, and quality or species-specific values, including access and connectivity.

(6) To establish an appropriate framework for joint decision making.

- Once a P2 Consultation and Accommodation Framework is in place, establish ongoing mechanisms for joint decision making between ACFN, MCFN, and statutory decision makers regarding water management as it may affect the LAR and the PAD.

- As the scientific data gaps are addressed, and as uncertainty is expressed appropriately and quantitatively, establish the selection of a long-term water management rule set.
- Once the improved science results are available, apply the new information to an appropriate decision making framework that includes defined knowledge-based risk thresholds and linked to the precautionary principle.
- Establish a strong role for federal agencies (DFO, HC, TC, INAC) as a mediating influence to ensure that the honour of the Crown is not swayed in favour of commercial interests within the context of the existing Treaty relationship with ACFN and MCFN.

(7) To put in place a monitoring and adaptive management plan that addresses the actual degree of scientific uncertainty.

- Based on sound environmental and social science, establish, and securely and adequately fund, for the duration that the P2 Framework is in force, an objective, transparent, and First Nations-led process for monitoring environmental and cultural effects based on a Treaty and aboriginal rights-based approach.

(8) Should the crown wish to rely on P2FC work, despite this review and advice, then ACFN and MCFN call on the Crown:

- To engage in immediate consultation with ACFN and MCFN regarding likely effects on ACFN and MCFN Treaty and aboriginal rights, and the levels of accommodation warranted.
- To engage the services of a skilled outside and independent team to review the P2FC science work, and fund and publish their findings, in full, through a neutral third party, approved by ACFN and MCFN, and with no other connections to Alberta or the oilsands industry.
- To require the researchers behind the P2FC to defend their work orally before a two-day (or longer) joint council of MCFN and ACFN elders and expert river users.

5.0 OVERALL RECOMMENDATION

The overall recommendation of this review is that the Crown should not adopt Option H, nor other management options for the Athabasca River, without consulting fully with ACFN and MCFN, and considering and implementing the recommendations of this report. ACFN and MCFN have serious issues with Option H. “Consulting fully” with ACFN and MCFN on the P2 Framework will require that the Crown work meaningfully with ACFN and MCFN, and in a timely manner, toward a solution for the Athabasca River P2 framework that fully addresses the requirements of the meaningful exercise of Treaty and aboriginal rights. In order for the P2 Framework to address these needs, the recommendations laid out in Chapter 4 must be considered and implemented..

If any of these recommendations cannot be demonstrably integrated, ACFN and MCFN expect that:

- The Crown will provide explicit details, in writing, on how it has considered these recommendations and rational for why the Crown believes they cannot be accommodated.
- The Crown will enter into discussions immediately with ACFN and MCFN on appropriate mitigation and accommodation options related directly to the ability of ACFN and MCFN to meaningfully exercise their Treaty and aboriginal rights. This discussion/consultation/ model needs to be directly integrated into the P2 Water Management Framework and be concluded before the P2 implementation.

In the absence of pursuing the above measures, the Crown would be implicitly creating further uncertainty for subsequent AENV water-licensing decisions.

For ease of reference, a tracking table for these recommendations (including space for actions that the Crown will take to address the recommendations) is provided in Appendix A.

6.0 REFERENCES

AECOM Canada Ltd 2009. *Review of Water Management Alternatives on Water Depth in the Lower Athabasca River: Draft Report*. Prepared for the Cumulative Effects Management Association. June 6, 2009. Calgary, Alberta, 26 p.

ACFN IRC 2010. *Letter dated February 1, 2010, to Alvaro Loyola, Alberta Environment and John Abbot, Shell Canada Energy, from Lisa King, Athabasca Chipewyan First Nation Industry Relations Corporation, RE: Shell Canada Ltd. – Jackpine Mine Expansion and Pierre River Mine Project EPEA Application File #s: 001-00245358, 005-00153125, 006-00153125 Water Act File #s: 00245489, 00186157 (“the Application”)*

Alberta Environment and Department of Fisheries and Oceans 2007. *Water Management Framework: Instream Flow Needs and Water Management System for the Lower Athabasca River*, 37 p.

Allison I, NL Bindoff, RA Bindschadler, PM Cox, N de Noblet, MH England, JE Francis, N Gruber, AM Haywood, DJ Karoly, G Kaser, C Le Quéré, TM Lenton, ME Mann, BI McNeil, AJ Pitman, S Rahmstorf, E Rignot, HJ Schellnhuber, SH Schneider, SC Sherwood, RCJ Somerville, K Steffen, EJ Steig, M Visbeck and AJ Weaver 2009. *The Copenhagen Diagnosis, 2009: Updating the World on the Latest Climate Science* The University of New South Wales Climate Change Research Centre (CCRC), Sydney, Australia, 60 p.

Anderson KE, AJ Paul, E McCauley, LJ Jackson, JR Post and RM Nisbet 2006. Instream flow needs in streams and rivers: the importance of understanding ecological dynamics. *Frontiers in Ecology* 4: 309-318.

Barnett TP, JC Adam and DP Lettenmaier 2005. Potential impacts of a warming climate on water availability in snow-dominated regions. *Nature*, 438: 303-309.

Barrow E and G Yu 2005. *Climate Scenarios for Alberta*. A Report Prepared for the Prairie Adaptation Research Collaborative (PARC) in co-operation with Alberta Environment, 73 p.

Beltaos S, T Prowse, B Bonsal, R MacKay, L Romolo, A Pietroniro and B Toth 2006. Climatic effects on ice-jam flooding of the Peace-Athabasca Delta, *Hydrol. Process.* 20:4031–4050.

Boag T and M. Vander Meulen 2010. *A Review of Lower Athabasca River Instream Flow Needs Phase II Water Management Framework - Fishes and Their Habitats*. Unpubl. Rept. Prep. for Athabasca-Chipewyan and Mikisew Cree First Nations. Prep. by Applied Aquatic Research Ltd. Calgary, AB. 25 p.

Bolch T, B Menounos and R Wheate 2010. Landsat-based inventory of glaciers in western Canada, 1985-2005. *Remote Sensing of Environment* 114:127-137.

Bothe R and B Franzin 2009. *Evaluation Criteria for Flow Alterations in the Lower Athabasca River—Channel Maintenance Flows*. Report prepared for the Phase Two Framework Committee, 27 p.

Burn D 2009. Trend Analysis for the Athabasca River (App. 3 in Lebel et al. 2009). Unpl. Rpt. Civil and Environmental Engineering, U. of Waterloo. Waterloo, ON. 11 p.

Candler C 2010. *Review of the P2FC Phase 2 Water Management Framework Outcome – Traditional Use*. Report prepared for the Athabasca-Chipewyan and Mikisew Cree First Nations, The Firelight Group, Victoria BC.

Canadian Council of Ministers and Environment 2009. *Regional Strategic Environmental Assessment in Canada: Principles and Guidance*, Canadian Council of Ministers and Environment www.ccme.ca/assets/pdf/rsea_in_canada_principles_and_guidance_1428.pdf .

Carver M 2010. *Review of the P2FC Phase 2 Water Management Framework Outcome – Hydrology, Geomorphology, Decision Framework*. Report prepared for the Athabasca-Chipewyan and Mikisew Cree First Nations, Aqua Environmental Associates, Nelson BC.

CEMA 2009. *Effects of Water Withdrawals from the Lower Athabasca River - IFNTTG Final Report*. Prepared for Cumulative Management Effects Committee. Prepared by Laughing Water, Arts and Science. Contract 2007-0033. 202 p.

Demuth MN and A Pietroniro 2001. *The Impact of Climate Change on the Glaciers of the Canadian Rocky Mountain Eastern Slopes and Implications for Water Resource-Related Adaptation in the Canadian Prairies, "Phase 1" – Headwaters of the North Saskatchewan River Basin*. Report to the Climate Change Action Fund – Prairie Adaptation Research Collaborative, PARC Project P55.

DFO 2003. *A Framework for the Application of Precaution in Science-based Decision-Making about Risk*. National library of Canada, Ottawa. 15 p.

DFO 2008. *Proceedings of the National Peer Review of the Lower Athabasca River Instream Flow Assessment and Water Management Framework*. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2007/032.

Doyle PF 1977. *Hydrologic and Hydraulic Characteristics of the Athabasca River from Fort McMurray to Embarras*. Alberta Research Council, SWE/77/02, 47 p.

Duinker PN and LA Greig 2006. The Impotence of Cumulative Effects Assessment in Canada: Ailments and Ideas for Redeployment. *Environmental Management* 37(2), 154-161.

Gerber R. 1989. Ice formation on northern rivers. P. 23 in: WC Mackay (ed.): *Northern Lakes and Rivers*. Occas. Publ. Boreal Inst. for Northern Studies. Univ. of Alberta, Edmonton, AB, 112 p.

Ghamry H, J Shatford and A Locke 2009a. *Evaluation Criteria for Connectivity of Tributaries in the Lower Athabasca River (Fletcher Channel) – Segment 1*. Report prepared for the Phase Two Framework Committee, 29 p.

Ghamry H, J Shatford and A Locke 2009b. *Evaluation Criteria for Connectivity of Perched Basins in the Lower Athabasca River– Segment 1*. Report prepared for the Phase Two Framework Committee, 37 p.

Gill K and S Rood 2009. Trend Detection in Historic Streamflows along Segment 5 of the Athabasca River, Alberta (App. 3 in Lebel et al. 2009). Unpl. Rpt. prepared for P2FC Climate subgroup. Environmental Science Program, U. of Lethbridge. Lethbridge, AB. 11 p.

Golder and Associates 2005. *A Compilation of Information and Data on Water Supply and Demand in the Lower Athabasca River Reach*. Unpl. Rpt. prepared for CEMA Surface Water Working Group. Ft. McMurray, AB. 40 p.

Golder and Associates 2009. *Athabasca River Water Requirements of Oil Sands Mining Operations* (partially included in Phase 2 Framework Committee Report 2010). Unpl. Rpt. #07-1345-0027 prepared for Oil Sands Developers Group. 12 p.

Government of Canada (GoC) 2000. *A Framework for Science and Technology Advice: Principles and Guidelines for the Effective Use of Science and Technology Advice in Government Decision Making*. National Library of Canada, 16 p.

Health Canada 2005. *Addressing Psychosocial Factors Through Capacity Building: A Guide for Managers of Contaminated Sites*. Ministry of Health, 22 p.

Intergovernmental Panel on Climate Change (IPCC) 2007. *Climate Change 2007: Synthesis Report*. This report, adopted section by section at IPCC Plenary XXVII (Valencia, Spain, 12-17 November 2007), represents the formally agreed statement of the IPCC concerning key findings and uncertainties contained in the Working Group contributions to the Fourth Assessment Report, 73 p.

Kelly EN, JW Short, DW Schindler, PV Hodson, M Ma, AK Kwan, and BL Fortin 2009. Oil sands development contributes polycyclic aromatic compounds to the Athabasca River and its tributaries. Environmental Sciences, www.pnas.org/cgi/doi/10.1073/pnas.0912050106, 6 p.

Kerkhoven EN 2008. *Development of a Meteorologic, Hydrologic, and Climatic Framework to Study the Impacts of Environmental Change on Flows in Large River Basins*. PhD Dissertation, Department of Civil and Environmental Engineering, University of Alberta, Edmonton, Alberta, 208 p.

Knighton D 1989. *Fluvial Forms and Processes*. Edward Arnold, London, 218 p.

Lebel M, E Kerkhoven, R Bothe, J Hornung and D Ohlson 2009. *Climate Change Sensitivity Analysis*. Unpubl. Report prepared for Phase 2 Framework Committee. 53 p.

McEachern P 2009. *Evaluation Criteria for Flow Alterations in the Lower Athabasca River – Dissolved oxygen in over-wintering fish habitat*. Report prepared for the Phase Two Framework Committee, 33 p.

Mote P, AF Hamlet, MP Clark, CP Lettenmaier 2005. Declining mountain snowpack in western North America, *American Meteorological Society*, January, 39-49.

National Academy of Sciences (NAS) 2010. *Advancing the Science of Climate Change, America's Climate Choices*, National Research Council of the National Academies.
<http://americasclimatechoices.org/panelscience.shtml>

Northern River Basins Study. 1994a. A General Fish and Riverine Habitat Inventory, Athabasca River, April to May, 1992. Northern River Basins Study Project Reports No. 32. Prepared by R.L. & L. Environmental Services Ltd.

Northern River Basins Study. 1994b. A General Fish and Riverine Habitat Inventory, Athabasca River, October, 1993. Northern River Basins Study Project Reports No. 40. Prepared by R.L. & L. Environmental Services Ltd.

Ohlson D, G Long, T Hatfield 2010. Phase 2 Framework Committee Report. Final report of the Phase 2 Framework Committee, 125 p plus appendices.

Paul AJ 2009a. *Evaluation Criteria for Flow Alterations in the Lower Athabasca River – Effective Spawning Habitat for Lake Whitefish*. Report prepared for the Phase Two Framework Committee, 27 p.

Paul AJ 2009b. *Evaluation Criteria for Flow Alterations in the Lower Athabasca River – Walleye Recruitment*. Report prepared for the Phase Two Framework Committee, 40 p.

Paul AJ and A Locke 2009a. *Evaluation Criteria for Flow Alterations in the Lower Athabasca River – Fish Habitat*, Report prepared for the Phase Two Framework Committee, 58 p.

Paul AJ and A Locke 2009b. *Evaluation Criteria for Flow Alterations in the Lower Athabasca River – Abundance and Diversity of Mesohabitat*, Report prepared for the Phase Two Framework Committee, 90 p.

Peters DL, TD Prowse, A Pietroniro and R Leconte 2006. Flood hydrology of the Peace-Athabasca Delta, northern Canada. *Hydrol. Process.* 20, 4073–4096.

Rood SB, J Pan, KM Gill, CG Franks, GM Samuelson and A Shephard 2006. Declining summer flows of Rocky Mountain rivers: Changing seasonal hydrology and probable impacts on floodplain forests. *J. of Hydrology*, 349:397-410.

Rood SB, GH Samuelson, JK Weber and KA Wywrot 2005. Twentieth-century decline in streamflows from the hydrographic apex of North America, *J. of Hydrology*, 306:215-233.

Sauchyn D and S Kulshreshtha 2008. Prairies, in *From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by DS Lemmen, FJWarren, J Lacroix and E Bush, Government of Canada, Ottawa, ON, 275-328.

Schindler DW and WF Donahue 2006. An impending water crisis in Canada's western prairie provinces, U.S. National Academy of Sciences, www.pnas.org/cqi/doi/10.1073/pnas.0601.568103.

Schindler DW and JP Smol 2006. Cumulative effects of climate warming and other human activities on freshwaters of arctic and subarctic North America. *Ambio* 35:160–168.

Sorokan, G. 2009. The Climate Factor. *The PEGG (December 2009 Edition)*. Association of Engineers, Geologists and Geophysicists of Alberta, <http://www.apegga.org/members/publications/peggs/Web12-09/The-Climate-Factor.html>

Toyra J and A Pietroniro 2005. Towards operational monitoring of a northern wetland using geomatics-based techniques. *Remote Sensing of Environment* 97:174-191.

Westland Resource Group 2009a. *Memorandum submitted to the Socio-Economic Task Group* Report to CEMA's Socio-Economic Task Group, Victoria, British Columbia, 5 p.

Westland Resource Group 2009b. *Impact Hypothesis Analysis: Effects of water withdrawal on traditional use of the Lower Athabasca River*. Report to CEMA's Socio-Economic Task Group, Victoria, British Columbia, 58 p.

Westland Resource Group. 2009c. *Traditional Use Mapping of the Lower Athabasca River: Information Summary*.

Wolman M and JP Miller 1960. Magnitude and frequency of forces in geomorphic processes. *Journal of Geology*, 68:54-74.

APPENDIX A: RECOMMENDATIONS TRACKING TABLE

#	Primary Issue or Concern	Recommended Action (or Info request)	Responsible Party	Date Due	Action Taken (date rec'd)	Was Action Adequate and Effective?
1	Implement the ABF, AXF, and EBF thresholds	Immediately establish, resource and implement, a tripartite (Federal, First Nation, Provincial) table of consisting of First Nations leadership and statutory decision makers from the Crown, all with clear mandates to negotiate a P2 consultation and accommodation framework as a priority companion to the P2 water management framework;	Crown	ASAP		
2	Implement the ABF, AXF, and EBF thresholds	Engage ACFN and MCFN at the tripartite table so that ACFN and MCFN can share existing or newly assembled confidential information including the traditional use study results and maps, collected in establishing their recommended ABF, AXF, and EBF.	Crown, ACFN and MCFN	Aug. 30, 2010		
3	Implement the ABF, AXF, and EBF thresholds	Negotiate direct accommodation measures for the effects of past water withdrawals by industry upon ACFN and MCFN Treaty and aboriginal rights over the duration of the Phase 1 framework.	Crown, ACFN and MCFN	ASAP and prior to launch of P2F		
4	Implement the ABF, AXF, and EBF thresholds	Negotiate establishment of a mutually agreeable process for determining accommodation for water withdrawals that have adverse effect upon ACFN and MCFN Treaty and aboriginal rights over the duration of the Phase 2 framework.	Crown, ACFN and MCFN	ASAP and prior to launch of P2F		
5	Implement the ABF, AXF, and EBF thresholds	Jointly with the ACFN and MCFN, implement evidence based ABF, AXF, and EBF frameworks on the Athabasca River before Dec. 31, 2010. If this cannot be achieved, precautionary thresholds should be set and implemented along with a timeline for completion of evidence based rules.	Crown, ACFN and MCFN	ASAP and prior to Dec. 31, 2010		

6	Implement the ABF, AXF, and EBF thresholds	Work with ACFN and MCFN to develop additional thresholds, criteria, and measures to assess potential impacts on section 35 rights using a Traditional Resource Use Plan model.	Crown, ACFN and MCFN	TBD		
7	Take immediate steps to prevent further harm.	Update how the P1 rules are applied by determining an up-to-date historic average hydrograph based on data to 2009, not to 2004 as it is now.	Crown	ASAP and prior to launch of P2F		
8	Take immediate steps to prevent further harm.	Suspend the permitting of new mines and the issuance of all water licenses in the region that have the potential to cause further harm to the LAR.	Crown	ASAP and prior to launch of P2F		
9	Take immediate steps to prevent further harm.	Slow down the renewal of water permits of existing mines so as to lower and cap the peak water withdrawal that will be needed by the oil sands industry from the LAR.	Crown	ASAP and prior to launch of P2F		
10	Take immediate steps to prevent further harm.	Establish a temporary precautionary (cutoff) flow of 100 m ³ /s at the Fort McMurray hydrometric station until a science-based EBF can be determined. When the flow at Fort McMurray drops below this precautionary threshold, allow no withdrawals except possibly minimal withdrawals (a total of less than 1 m ³ /s) to prevent freezing.	Crown	ASAP and prior to launch of P2F		
11	Take immediate steps to prevent further harm.	Establish a temporary precautionary ABF at a level of 1600 m ³ /s, and a temporary precautionary AXF at a level of 400 m ³ /s	Crown	ASAP and prior to launch of P2F		
12	Take immediate steps to	Apply the precautionary principle in adjudicating all future oilsands mining water license applications.	Crown	ASAP and prior to		

	prevent further harm.			launch of P2F		
12	Take immediate steps to prevent further harm.	Review existing water allocations against current use and consider whether these allocations are still appropriate.	Crown	ASAP and prior to launch of P2F		
13	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Determine an ongoing interim precautionary flow based on the likely current 1/100 year low flow incorporating our best understanding of the current flow regime as modified by climate change to date. Engage independent outside climate change experts to help establish the current flow expectation corresponding to this return period.	Crown	ASAP		
14	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Conduct field studies to address data gaps, including data regarding tributaries, and including refinement of navigable limits of streams adjoining the Athabasca, as well as confirming evidence based ABF and AXF numbers on the river, and using flow models.	Crown, ACFN and MCFN	ASAP		
15	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Address inadequate information regarding riparian vegetation change and wildlife and fisheries change related to riparian areas and streams adjacent to the Athabasca River, particularly related to culturally important species upon which Treaty and aboriginal rights depends (e.g., muskrat, beaver, moose, various medicine plants, and waterfowl).	Crown, ACFN and MCFN	ASAP		
16	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Revise models to address deficiencies and incorporate the additional field data promptly as they become available.	Crown, ACFN and MCFN	ASAP		

17	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Update the Northern River Basins Study and apply many of the recommendations made in regards to the LAR.	Crown	ASAP		
18	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Propagate error through the models and risk assessment to quantify aggregate uncertainty.	Crown	ASAP		
19	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Present results to decision makers (including First Nations) along with defensible risk thresholds and clearly expressed confidence limits of the modeled outcomes.	Crown, ACFN and MCFN	ASAP		
20	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Make arrangements to have all data (e.g., RAMP data) available for use in this scientific work.	Crown	ASAP		
21	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Install a hydrometric station near the a) Athabasca mouth and b) in the boundary between Segment 3 and 4, or in an alternate location agreed to by the parties. Secure resources to ensure that data are reported year-round and on a minimum weekly basis during the ice-covered period. This station needs to be “transparent” so that stakeholders can ensure that proponents are compliant with commitments relative to their licence allocation for water withdrawal.	Crown, ACFN and MCFN	ASAP		
22	Initiate a program of studies to refine and improve ABF, AXF	Acquire the flow data for all gauges on the Athabasca and use these data to improve knowledge of the basin water budget.	Crown	ASAP		

	and EBF.					
23	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Calibrate and validate models over the coming year.	Crown, ACFN and MCFN	Annual		
24	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Quantify error and propagate through the models by establishing the confidence level associated with each input parameter of each model used in building the Phase 2 options.	Crown	ASAP		
25	Initiate a program of studies to refine and improve ABF, AXF and EBF.	Provide the modeled outputs, complete with quantitative confidence limits and the additional qualitative assumptions that accompany each metric.	Crown	ASAP		
26	Interpret science within the context of a basin analysis.	Engage an independent outside expert on climate change projections to develop a credible analysis of likely future climates. Use these projections to determine the corresponding changes in LAR mean annual flow, winter low flow, summer low flow, and spring peak flow. Propagate these hydrologic results, as appropriate, through each corresponding and relevant Evaluation Criteria model. (See section 2.1.3 for further information.)	Crown	ASAP		
27	Interpret science within the context of a basin analysis.	Integrate findings from the LARP into a complete climate change analysis to develop a full suite of plausible climate-change LAR flow projections out to 2070 for use in model sensitivity analyses and informed decision-making.	Crown, ACFN and MCFN	ASAP		
28	Interpret science within the context of a basin analysis.	Conduct a basin analysis, setting the LAR in the context of the wider regional issues, including consideration of cumulative effects from all human impacts, the Alberta Land-Use Framework, the	Crown, ACFN and MCFN	ASAP		

		basin water budget, and all surface- and ground-water withdrawals for tributaries to the LAR and in other areas adjacent to these rivers and with a focus on the Treaty rights of First Nations.				
29	Interpret science within the context of a basin analysis.	Undertake a rights-based analysis that ensures that the appended information (Appendix B) are answered and a Traditional Resource Use Plan (Appendix C) is developed.	Crown, ACFN and MCFN	ASAP		
30	Interpret science within the context of a basin analysis.	Quantify other withdrawals and pressures as well as oil sands related withdrawals, as well as forest, wetland and muskeg removal, to further understand the cumulative impacts to the Athabasca River.	Crown, ACFN and MCFN	ASAP		
31	Develop a management plan to assist in considering traditional knowledge and use in resource and land use planning and decision making	Support the development of a Traditional Resource Use Plan consisting of a comprehensive regional planning level study of aboriginal knowledge, use, Treaty and aboriginal related to the Athabasca River and adjoining watersheds, and focusing on the underlying resources needed for the meaningful practice of Treaty and aboriginal rights. Developing this plan would require that the types of studies detailed below would be completed.	Crown, ACFN and MCFN	ASAP		
32	Develop a management plan to assist in considering traditional knowledge and use in resource and land use planning and decision making	Undertake, with ACFN and MCFN, a regional cumulative effects assessment on the Treaty and aboriginal rights of CFN and MCFN. Such a study should be based on quality environmental and social science, and completed under the direction of the communities involved. It should consider the effects of the P2 Framework in combination with other projects such as the proposed construction of the 'Site C' project on the Peace River system.	Crown, ACFN and MCFN	ASAP		
33	Develop a management plan to	Resource additional First Nations-directed work related to health, diet, practice of Treaty and	Crown, ACFN and MCFN	ASAP		

	assist in considering traditional knowledge and use in resource and land use planning and decision making	aboriginal rights, and avoidance patterns related to contaminants, as well as identification of priority solutions, as needed. This work should be considered within a wider context of cultural and environmental effects related to the Athabasca River region, and should take into account a capacity building approach to psychosocial effects consistent with Health Canada advice documents (Health Canada 2005).				
34	Develop a management plan to assist in considering traditional knowledge and use in resource and land use planning and decision making	Resource additional quality work, directed by First Nations, of how transmission of cultural knowledge can be supported in the face of avoidance areas related to water quality or water level including identification of specific obstacles to traditional knowledge transfer the best ways of overcoming these obstacles, supported by, and developed in consultation with, First Nations.	Crown, ACFN and MCFN	ASAP		
35	Develop a management plan to assist in considering traditional knowledge and use in resource and land use planning and decision making	Conduct a corresponding operational level study of Treaty and aboriginal rights and traditional knowledge, including detailed community-based documentation and annual monitoring of cultural and spiritual values along the Athabasca River itself, including habitations, trails, subsistence areas, and quality or species-specific values, including access and connectivity.	Crown, ACFN and MCFN	ASAP		
36	Appropriate Framework for Joint Decision Making re. LAR	Once P2 Consultation and Accommodation Framework is in place, establish ongoing mechanisms for joint decision making between ACFN, MCFN, and statutory decision makers regarding water management as it may affect the LAR and the PAD.	Crown, ACFN and MCFN	ASAP		
37	Appropriate Framework for Joint	As the scientific data gaps are addressed, and as uncertainty is expressed appropriately and	Crown, ACFN and MCFN	ASAP		

	Decision Making re. LAR	quantitatively, establish the selection of a long-term water management rule set.				
38	Appropriate Framework for Joint Decision Making re. LAR	Once the improved science results are available, apply new information to an appropriate decision making framework that includes defined knowledge-based risk thresholds with a default to the precautionary principle	Crown, ACFN and MCFN	ASAP		
39	Appropriate Framework for Joint Decision Making re. LAR	Establish a strong role for federal agencies (DFO, HC, TC, INAC) as a mediating influence to ensure that the honour of the Crown is not swayed in favour of commercial interests within the context of the existing Treaty relationship with ACFN and MCFN.	Crown	ASAP		
40	Appropriate Framework for Joint Decision Making re. LAR	Once P2 Consultation and Accommodation Framework is in place, establish ongoing mechanisms for joint decision making between ACFN, MCFN, and statutory decision makers regarding water management as it may affect the LAR and PAD.	Crown, ACFN and MCFN	ASAP		
41	Monitoring and Adaptive Mngmnt	Based on sound environmental and social science, establish, and securely and adequately fund, for the duration that the P2 Framework is in force, an objective, transparent, and First Nations led process for monitoring environmental and cultural effects based on a Treaty and aboriginal rights based approach.	Crown, ACFN and MCFN	ASAP		
42	Should the crown wish to rely on P2FC work, despite this review, then...	Engage in immediate consultation with ACFN and MCFN regarding likely effects on ACFN and MCFN Treaty and aboriginal rights, and the levels of accommodation warranted.	Crown, ACFN and MCFN	ASAP		
43	Should the crown wish to rely on P2FC work, despite this review,	To engage the services of a skilled outside and independent team to review the P2FC science work, and fund and publish their findings, in full, through a neutral third party, approved by ACFN and MCFN, and	Crown, ACFN and MCFN	ASAP		

	then...	with no other connections to Alberta or the oilsands industry.				
44	Should the crown wish to rely on P2FC work, despite this review, then...	Require the researchers behind the P2FC to defend their work orally before a two day (or longer) joint council of MCFN and ACFN elders and expert river users.	Crown, ACFN and MCFN	ASAP		

APPENDIX B: INFORMATION REQUIREMENTS

Answering the following information requirements will assist the Rown in understanding ACFN and MCFN rights, and assessing the potential and actual impacts of development on those rights. These information requirements come from MCFN and Chipewyan Prairie First Nation's joint submission to Alberta Sustainable Resources Development on the Land Use Framework. They have been submitted by ACFN and MCFN to Alberta Environment and DFO on several occasions since then. Most notably, they were submitted to Department of Fisheries and Oceans on January 18th, 2010 in the joint report of ACFN and MCFN entitled "Relationship between the Lower Athabasca River and the Traditional Uses and Rights of the ACFN and MCFN (Draft) Summary Report."

We wish to make it clear that the information contained herein is preliminary in nature. We need input from experts to fully and properly determine the precise nature of the information required to assess impacts of development on our rights.

A. General Information Requirements

1. Assessment of uses of the lands contained within the Plan area by all of the ATC First Nations, Métis Groups and other non-Aboriginal peoples within the area. There is already growing pressure on our Traditional Territories from various kinds of land use – exploration, industrial development, camps, recreational and commercial resource use, use of lands for traditional purposes by our First Nations and other First Nations, to name some examples. As more of our Traditional Territories are used for development and other activities, this puts more pressure on those parts of our Traditional Territories that have not been developed.
2. As stated at p. 4 of these Submissions, the following kinds of information must be collected and analyzed as part of the Plan:
 - (a) The extent to which existing industrial development within our Traditional Territories has already adversely affected our ability to exercise our rights;
 - (b) How planned/reasonably foreseeable development has the potential to further adversely affect our ability to exercise our rights¹;

¹ Here, we note that "reasonably foreseeable" development must focus on the rate of development in the past as a projection tool for examining future development. This is different than Alberta's current practice of simply examining projects that are under regulatory review, because those projects show only a fraction of the actual future development(s).

- (c) The impact of the grants of tenure throughout our Traditional Territories on our ability to exercise our rights; and
- (d) Identification of the lands and resources which our First Nations require to sustain ourselves now and into the future, including identification of protected areas.

B. Baseline Information to Inform Development of the LUF and the Plan

1. In our view, proper baseline information is needed to understand the potential direct, indirect and cumulative impacts of existing, planned and reasonably foreseeable industrial development on our ability to exercise our rights. We regard 1965, when the impacts of intensive oil sands development began to be felt in our Traditional Territories, as the date needed to establish the baseline data. The following information is required to inform the baseline:

- (a) Quantitative Information on our Traditional Territories:
 - (i) Traditional Territory study area² and size in miles² and hecatres²
 - (ii) Fixed Sites of Cabins, Camps, Communities, Historical Trails, Graves, Trap Lines, Spiritual sites (locations to be kept private unless authorized by the First Nations) within Traditional Territories
 - (iii) Current and past potable water sources and infrastructure.
 - (iv) Current and past travel routes within our Traditional Territories.
 - (v) Amount of land within Traditional Territory already taken up for development (energy, forestry, agriculture, pipelines, project footprints and related infrastructure, seismic activity, etc.) and analysis of how this affects traditional cycles of use.
 - (vi) Traditional activities potentially impacted by reasonably foreseeable industrial development.
- (b) Quantitative and qualitative information on Current and Historical Traditional Uses (hunting, fishing, plants and medicines, spiritual use):
 - (i) Hunting

² Traditional territories of historically nomadic First Nations have extended vast distances and are very difficult to limit or measure in conventional terms. Over time, traditional activities have been focused in various areas associated with camps, summer villages and central areas. It is therefore necessary to define a study area for the First Nations which will properly reflect where the First Nations have carried out their traditional pursuits historically as well as today.

- (A) Main species hunted for food and domestic purposes and the uses made of those species;
 - (B) Locations and access routes currently used for hunting main species
 - (C) Changes from 40, 20 and 10 years ago in locations and access routes used and costs associated with hunting main species based on such changes, both qualitative and quantitative
 - (D) Estimated amount of current consumption and percentage of total meat intake from hunted animals.
 - (E) Estimate of change in amount of hunted meat as a percentage of total meat consumed from 40, 20 and 10 years ago
- (c) Fishing
- (i) Main species fished for food and domestic purposes and uses made of those species
 - (ii) Locations currently used for fishing main species
 - (iii) Changes from 40, 20 and 10 years ago in locations used for fishing main species and costs associated with such changes, both qualitative and quantitative
 - (iv) Estimated amount of current consumption and percentage of total fish intake from fishing
 - (v) Estimate of change in amount of fish as a percentage of total fish consumed from 40, 20 and 10 years ago.
- (d) Gathering Plants and Medicines
- (i) Main species gathered and uses made thereof
 - (ii) Locations currently used for gathering main species
 - (iii) Changes from 40, 20 and 10 years ago in locations used for gathering main species and costs associated with those changes
 - (iv) Changes in frequency of gathering activities.
- (e) Spiritual and Cultural Use

- (i) Locations currently used for spiritual and cultural practices (locations to remain confidential unless disclosure is authorized by the First Nations)
 - (ii) Changes in location from 40, 20 and 10 years ago and costs associated with those changes, both qualitative and quantitative
- (f) Traditional Economic Pursuits
 - (i) Animals, plants, medicines used for barter or trade
 - (ii) Changes in bartering and trading from 40, 20 and 10 years ago and reasons for change
 - (iii) Estimated cost of purchasing goods previously gathered, hunted, fished, or traded or bartered.
- (g) Traditional Resource Pursuits
 - (i) Current forest and mineral resources gathered and used.
 - (ii) Changes in forest and mineral resources gathered and used from 40, 20 and 10 years ago.
- (h) Socio-Economic Information
 - (i) Current demographics - age, family units, education, sex, private sector employment, FN public sector employment, self-employment)
 - (ii) Changes in demographics from 40, 20 and 10 years ago
 - (iii) Predicted demographics in 10 years based on current trends
- (i) Income
 - (i) Amount and sources (trapping, wage employment, etc.) of income
 - (ii) Changes in amounts and sources of income from 40, 20 and 10 years ago
 - (iii) Number and percentage of individuals and families receiving social assistance
 - (iv) Changes in number and percent of social assistance recipients from 40, 20 and 10 years ago.

- (j) Expenditures
 - (i) Expenditures on food, housing, travel and recreation
 - (ii) Changes in expenditures from 40, 20 and 10 years ago
 - (iii) Resource Sector Employment and Income (energy, forestry, agriculture, other)
 - (iv) Current number of First Nation embers employed in resource sector
 - (v) Changes in number of people employed in resource sector from 40, 20 and 10 years ago

- (k) Health Information:
 - (i) First Nation health problems (including cancer and respiratory illnesses) by age and sex
 - (ii) Changes in health problems from 40, 20 and 10 years ago
 - (iii) Deaths (ages, causes)
 - (iv) Changes in causes of deaths from 40, 20 and 10 years ago
 - (v) Health problems and causes of death compared to regional population

C. Cumulative Impacts

As noted earlier, Alberta assess the cumulative effects of development rather than the cumulative impacts of development and it does so from a very limited and narrow standpoint. In our view, this results in flawed or incomplete predictions. Information required to effectively assess the cumulative impacts of existing, planned and reasonably foreseeable development and their significance on the ability of the First Nations to exercise their rights now and into the future is often missing from this narrow Alberta focus. For example, companies are not required to assess things such as exploration and winter drilling activities, seismic activity, and forestry or parts thereof. We are simply not prepared to accept Alberta's narrow, legislated definition of "cumulative effects" in the development of the Plan. What is needed is a proper study of regional cumulative impacts and not narrow, project-specific effects. In addition to properly identifying the existing, planned and reasonably foreseeable industrial development that must be assessed in a cumulative impacts assessment, it is also necessary to include in such assessments:

- The full footprint of the existing and future projects at issue

- Cut-blocks and linear developments such as roads, pipelines and power lines, including the impacts of same³

Additional information required to properly assess the cumulative impacts of development on our rights includes:

1. Cumulative Impact on our Traditional Territories and their Uses
 - (a) Amount (quantity and percentage) of potential oil sands deposits within our Traditional Territories
 - (b) Amount of land (quantity and percentage) currently leased for oil sands exploration within our Traditional Territories
 - (c) Percentage of oil sands leases developed in our Traditional Territories in past 10, 20, 30, and 40 year increments
 - (d) Amount of land within our Traditional Territories potentially impacted by other oil sands developments (reasonably foreseeable development and not simply applied-for projects)
 - (e) Amount of land within our Traditional Territories already taken up for other non-oil sands developments (i.e. converted from natural vegetation)
 - (f) Amount of and within our Traditional Territories that is planned/reasonably foreseeable to be taken up by non-oil sands development
 - (g) Amount of our Traditional Territories lost to Traditional Uses because of direct and indirect impacts of development and how this impacts ability to carry out traditional pursuits, livelihood/usual vocations.
2. Impacts of Forestry
 - (a) Forest tenure holders in our Traditional Territories
 - (b) Size of forest tenures in our Traditional Territories
 - (c) Estimated size of area of direct and indirect disturbance to wildlife relied upon by our First Nations within our Traditional Territories
3. Linear Corridors

³ For example, it is known that linear developments including seismic lines and pipelines provide open access that is used by ATVs for decades after they have been constructed. This indicates that there will be long-lasting effects of these developments, much past the closure scenarios indicated in many of the existing project-specific cumulative effects studies. These effects are therefore cumulative and must be included as part of proper information gathering.

- (a) Identification of all linear corridors (pipelines, transmission lines, roads, seismic lines) in Project area.
 - (b) Estimated size of area of direct and indirect disturbance to wildlife relied upon by our First Nations within our Traditional Territories
4. Other tenure holders
- (a) Identification of all other tenure holders in the Project area including exploration leases.
 - (b) Size of area of held by other tenure holders in our Traditional Territories
5. Reasonably Foreseeable Future Developments
- (a) The identification of all planned and reasonably foreseeable industrial activities within our Traditional Territories
 - (b) The infrastructure required to serve the future developments.
 - (c) The number of access roads, and size of accessible area, for all future developments, including exploration, based upon current averages.
6. Other Information
- (a) Impacts of climate change within the area of the Plan/within our Traditional Territories

APPENDIX C: TRADITIONAL RESOURCE USE PLAN

Set out below are what the elements of a Aboriginal and Treaty Rights Assessment and a Traditional Resource Use Plan (TRUP) submitted to Alberta Environment and Shell Canada on February 1, 2010 (ACFN IRC 2010). ACFN and MCFN are working on detailed proposals (including budget and timelines) for developing a TRUP.

Background

Current EIA process does not analyze potential impacts of development from a Treaty rights perspective. The ACFN Treaty Rights are based upon their traditional livelihood and culture. Environmental studies conducted as part of the EIA process do not capture the impacts on their cultural ecosystem and the socio-economic studies do not even identify the ACFN as an entity to be studied. The needs of ACFN to exercise their rights in a meaningful and viable fashion are not studied from an ACFN perspective. These gaps in data are an impediment to meaningful decision making and often slow down regulatory processes

ACFN is concerned that current regulatory review processes the Shell Jackpine Mine and Pierre River Mine Applications will not properly examine potential impacts to ACFN's Treaty 8 rights. Some of the reasons are set out below.

- Social and cultural indicators are not linked and applied in an EIA Application to the assessment of impacts to the exercise of a First Nation's rights. For example, an Application will indicate potential changes to plants or animals and the Proponent will set out mitigation measures; however, consideration needs to be given to what that change means to the traditional resource user (the direct, indirect and cumulative impact to their livelihood, their ability to teach the next generation how to exercise the right, and the ability to have places to exercise the right that are not heavily impacted by development). Without consideration of these issues, the true ability of ACFN harvesters to exercise their rights is not assessed.
- The EIA included in these project applications does not seek to understand or consider the impacts on the ACFN cultural ecosystem, nor has Alberta or Shell sought to fully understand this information. Neither the ACFN livelihood nor their cultural ecosystem have been linked to the very things the EIA is supposed to assess such as water quality, air emissions, increase in noise, impacts on plants and animals and how all of this is in fact holistically connected.
- The methodologies in project-specific impact assessments are largely inadequate for elucidating the key relationships among socio-cultural and ecological aspects that support the meaningful practice of rights.
- There is no attempt in the Applications to assess the true impact of development from the Projects, and other developments within ACFN's Traditional Lands, on their ability to exercise their rights given the large cumulative infringements in the region. What attempt has been made by AENV or Shell to truly discern, as cases like *Sparrow* and *Van der Peet* require, the aboriginal perspective of the rights at stake in terms of assessing impacts?

- There is often an assumption that “mitigation” means giving jobs to First Nation members or taking fairly minor steps such as re-planting vegetation that will be lost. There is no discussion of the social and cultural impacts to the First Nation of taking up yet more of their lands, or removing more places where they can practice their rights and teach the next generation. There is an assumption that there will always be “other places”, animals, plants, waters and resources where this can be done which is contrary to the Mikisew decision. This is why there is a need to look at the tenures that have already been granted in the vicinity of the Project, both within ACFN’s Traditional Lands and extending to and surrounding an ACFN reserve, because a project-specific approach ignores the fact that there will likely be development on many of those tenures likely destroying the ability of the First Nation to use the reserve for traditional purposes.

Set out below are some other things that are not typically examined in EIA Applications nor in assessing potential impacts of development, but need to be examined/assessed as part of the duty to consult:

- **Impacts of existing disturbance:** impacts on Treaty rights are already adversely impacting ACFN’s Treaty 8 rights in many parts of their Traditional Lands. What we do not learn from EIAs is how the addition of disturbance (both project specific and other foreseeable projects) affects the already diminished exercise of Treaty rights. EIAs start with the "existing environment" as a baseline, but no one has assessed how much of a First Nation’s ability to exercise Treaty rights is already affected. Past EIAs have not included an infringement/adverse impact assessment on rights and hence, we do not know the effect of the additional infringement/adverse impact to something unknown.
- **Fragmentation affecting Treaty rights:** the fragmentation of the landscape also affects Treaty rights, not just the clearing of an area. Fragmentation can only be assessed if the connections in the full cultural ecosystem are assessed.
- **Disturbances by all industry activities:** most small projects, including exploration, camps, roads and even pilot projects do not trigger an EIA or require a cumulative effects assessment. These projects are, in turn, not usually shown on the disturbance maps shown in EIAs with the result that the predicted cumulative effects (on Treaty rights and anything else) are underestimated. This omission brings into question the reliability of the entire cumulative effects analysis.
- **Mitigation measures:** are usually project specific and it may be assumed that such mitigation measures are sufficient; however, they do not address potential direct, indirect and cumulative impacts on Treaty 8 rights
- **The need to access traditional areas to practice Treaty rights:** there is no assessment or requirement that would deal with the disruption of travel/ability to access parts of the Traditional Territory – gates, infrastructure, project footprints, etc.

Traditional, Cultural and Socio-Economic Assessment

The shortcomings of the current EIA and TOR system can only be remedied by conducting a proper impact assessment on Aboriginal and Treaty rights. There has been some discussion of

the problems with the current EIA and traditional land use study methodologies above. This section will provide some suggestions for conducting impact studies that capture the impacts on Treaty rights and socio-cultural ecosystems.

The nature of Aboriginal communities in the Treaty 8 area requires analysis of two inter-related socio-economic systems, 1) what could be called traditional activities and 2) mainstream socio-economic activities. In order to capture these activities the assessment requires two associated foci: 1) a thorough traditional land use and activities study integrated with; 2) a socio-economic conditions study. Although some information on each of these areas is included in current practices, the current EIA process (beginning with the Terms of Reference that guide the assessment) does not specify that links amongst these areas are made, especially with respect to an assessment of rights.

Socio-Economic Analysis

The primary failure of the current methodology is that socio-economic studies are conducted based upon an urban or rural region without identifying the aboriginal and treaty rights holders' conditions. Since the First Nations and Métis groups have different rights each group requires a separate study to identify the specific effects on that particular group. For example if the large development projects are preventing a First Nation from maintaining its language or traditional knowledge, that will not be relevant or important to non-native residents of Fort McMurray or Fort Chipewyan who are typically included in socio-economic study statistics associated with a typical SEIA.

Because of the differences in value systems and the Aboriginal legal rights, a socio-economic assessment must assess the relative importance of traditional practices and their relationship with mainstream social and economic activities. For the study to be used in the mitigation and compensation processes of consultation, quantification of changes in social and economic activities must be included. For example, the study should indicate the portion of time spent on traditional activities versus mainstream activities and how the portion has changed over time. A socio-economic study of a rights bearing community:

- 1) Must include and be limited to members of the First Nation or Métis community who are rights holders.
- 2) Should include typical as well as traditional issues. Examples:
 - a. Time spent in wage earning activities versus time spent on the lands hunting and gathering. (time and income, employment, activities).
 - b. Level of education in schools versus knowledge about traditional pursuits (traditional knowledge).
 - c. Consumption of traditional foods versus store bought foods.

In addition, the ACFN has the right to determine how they will exercise their rights over time. This requires, in addition to the proper impacts analysis on traditional lands and socio-economic conditions, a Traditional Resources Use Plan.

Purpose and Objectives of a Traditional Resources Use Plan (TRUP)

The purpose of the traditional resource use plan would be to provide credible, sufficient and reliable information on the land and resource needs of ACFN for the meaningful exercise of their Treaty 8 rights within their Traditional Lands now and into the future. Consideration of this information will lead to a more credible system of decision making which integrates FN information, and would ACFN, Industry and the Crown in making decisions about land and resource development.

Specific objectives are:

- Create a vision for what constitutes the meaningful practice of ACFN Treaty 8 rights currently and in the future;
- Identify what resources are integral to the meaningful practice of ACFN Treaty 8 rights;
- Determine the socio-cultural, ecological and economic conditions (including thresholds of acceptable change) that support the meaningful practice of ACFN Treaty 8 rights for each identified resource currently;
- Predict the socio-cultural, ecological and economic conditions that support the meaningful practice of the rights into the future;
- Identify key drivers of change and impacts to the resources and the conditions supporting ACFN use of the resource;
- Recommend land and resource management strategies that would ensure the continued meaningful exercise of ACFN Treaty 8 rights (e.g., protected or conservation areas; hunting restrictions; setbacks; timing windows; etc.)
- Integrate the information into an appropriate management tool format (e.g., GIS; planning documents) for use by decision-makers.

Time Frame to develop a TRUP

We estimate that this would take approximately one year of full time work by a dedicated team of experts to complete. This would ensure that there is sufficient time to conduct interviews, including community surveys, collect and analyze data, present data. Please note that the five month delay in your response to our questions should not be held against ACFN. This process would include the proper traditional land use assessment and the socio-economic assessment outlined above.

Project Team

The development of the TRUP would require guidance from and participation of the ACFN community in an interdisciplinary research exercise. An ACFN committee would be formed to guide provide input into key research stages, to work closely with the interdisciplinary research

team to understand the ACFN issues of concern, to advise on liaising with the remainder of the ACFN community and on the selection of participants for workshops, interviews (and possibly fieldwork).

We anticipate that an interdisciplinary research team consisting of people with social science, landscape ecology, wildlife ecology, plant ecology, land and resource planning and project management expertise would be key to successful completion of the TRUP.

Required Information

A large variety of information will need to be collected, including, but not limited to:

- Key resources on which ACFN relies: fish, wildlife, vegetation, plants
- Information on the use of the resources: food, social, ceremonial, commercial, spiritual uses, cultural uses
- Specific information on the demographic conditions associated with the use and harvest of resources:
 - Number of, and demographics of, ACFN members that utilize certain types of resources and amount that is used (the measure of use must be specified – household, individual, etc.)
 - Resource pooling and sharing – are there relationships of reciprocity and exchange amongst ACFN members and non-ACFN members that contribute to the use of the resource?
 - Demographic information on who is harvesting
- Specific information on the harvesting of each resource (including differentiation amongst harvesting preferences for different uses of the same resource, if applicable):
 - amount harvested
 - timing of harvest (when is a resource harvested?)
 - preferred places for harvesting
 - preferred methods for harvesting
 - impediments experienced to harvest, if any
- Ecological requirements for each resource
- The socio-cultural and economic conditions required to harvest those resources, including:
 - Remoteness / Privacy

- Aesthetics (visual, noise, odour)
 - Lack of contamination
 - Safety and risk
 - Access
 - Economic conditions (time available for harvest; costs associated with access)
 - Impacts of tenure grants – availability of lands and corridors
 - Multi-generational considerations (e.g., is it safe to bring children?)
- Key issues affecting resource harvest (ecological, socio-cultural and economic) currently
 - Key issues that could affect resource harvest in the future
 - E.g., abundance of resource and competition for resources as a result of growing First Nations and non-First Nations populations in the region
 - Thresholds of acceptable change for conditions sustaining each resource
 - “Best Management Practices” and culturally-appropriate management practices

Methods

Some of the required information may be available as part of existing data sets; however, much of the information (especially quantitative information and detailed work on “conditions” or preferences) has not yet been collected. We will leave it up to the Project Team to detail the most appropriate methods for collection of information. However, we expect that there will be a variety of interviews, surveys and focus groups that would be required. Field work may also be required. Modelling would be required to examine possible future scenarios and to inform community work on thresholds identification.

Investing in our Future:

Responding to the Rapid Growth of Oil Sands Development

Final Report

December 29, 2006

Table of contents

List of Tables	2
List of Figures	3
1. Executive Summary	4
2. Introduction	16
3. Setting the context	18
What are the oil sands?	18
Upgrading oil from the oil sands	20
What do the oil sands mean for Alberta?	21
How are projects approved?	22
4. Projecting future growth	26
Where do we stand today?	26
The outlook to 2011	35
In summary	45
5. Where are the gaps?	47
Housing	48
Transportation	60
Basic municipal infrastructure	69
Health Care	80
Education	89
Social services	98
Policing, fire and emergency response	106
Environmental impact	112
6. Drawing conclusions	116
7. Recommendations	130
Part 1: Over-arching recommendations	130
Part 2: Addressing gaps in the Regional Municipality of Wood Buffalo/Fort McMurray area	135
Part 3: Addressing gaps in Cold Lake – Bonnyville and Peace River Areas	142
Part 4: Addressing gaps in the Industrial Heartland	143
Part 5: Next steps	144
Part 6: Costing of recommendations	144
Part 7: Outstanding policy issues	145
8. Concluding comments	150
Appendix 1: Acknowledgements and Methodology	151
Appendix 2: List of organizations consulted	153
Appendix 3: Major Oil Sands Project List	160
Appendix 4: Selected maps	169
Bibliography	176

LIST OF TABLES

Table 1	Alberta Energy Reserves and Production	30
Table 2	Initial In-Place Volumes of Crude Bitumen	31
Table 3	Housing Starts for Regional Municipality of Wood Buffalo	50
Table 4	A Comparison of Cost of Living Allowances in the Public Sector	51
Table 5	Housing Starts in the City of Cold Lake, Town of Bonnyville and M.D. of Bonnyville	54
Table 6	Town of Peace River and Northern Sunrise County Housing Starts	56
Table 7	Land Available for Housing in the Fort McMurray Urban Service Area – Current and Future Development	58
Table 8	Comparison of Regional Issues Working Group Plans to Provincial Government Funding Commitments	66
Table 9	Capital Commitments in the Regional Municipality of Wood Buffalo	67
Table 10	Capacity of Basic Municipal Infrastructure in the Three Oil Sands Regions	70
Table 11	Total Provincial Government Funding for Municipalities in the Oil Sands Regions (2006 – 2007)	74
Table 12	Required Infrastructure Expenditures for Basic Municipal Infrastructure for the Regional Municipality of Wood Buffalo	76
Table 13	Impact of Cost Escalations	78
Table 14	Indicators of Health Care Services in Selected Communities	81
Table 15	Selected Satisfaction Levels (percentages)	81
Table 16	Doctors and GPs per 100,000 Population (March 31, 2006)	82
Table 17	Beds in Service to March 31, 2006	83
Table 18	Comparison of Municipal Census and Alberta Health Care Registrations (2005)	87
Table 19	Average Change in Enrolments and Student Population	90
Table 20	Satisfaction and High School Completion Ratings	91
Table 21	Operating Funding for School Boards in the Oil Sands Areas	95
Table 22	Homeless Population of Five Major Alberta Cities	98
Table 23	Community Facilities in the Oil Sands Regions	102
Table 24	Ratio of Police to Population and Relative Activity of the Detachments	108
Table 25	Crime Rate and Criminal Code Case Load	108

LIST OF FIGURES

Figure 1	Alberta's Three Oil Sands Areas	19
Figure 2	Crude Oil and Crude Bitumen Reserves	27
Figure 3	Crude Oil Reserves by Country	28
Figure 4	Crude Oil Production by Country	29
Figure 5	Bitumen Production 2005	32
Figure 6	Oil Sands Investment	33
Figure 7	Total Crude Production and Producing Crude Oil Wells	34
Figure 8	Crude Oil Production in Alberta	35
Figure 9	GDP Impacts on Alberta, Rest of Canada and Rest of The World	39
Figure 10	Government Revenues by Jurisdiction	41
Figure 11	Employment Impacts on Alberta, Rest of Canada and Rest of the World	42
Figure 12	Debt as a Percentage of Allowable Debt Limit (2005)	71

Executive summary

Purpose

To address the current challenges resulting from the rapid pace of oil sands development, and to anticipate the impacts of continuing growth, the Oil Sands Ministerial Strategy Committee was directed by Cabinet to develop a coordinated short-term action plan to address the social, environmental and economic impacts of oil sands developments.

It is important to note that this report makes no comment on the pace of oil sands development. The report identifies what services and infrastructure are required no matter what pace of development occurs.

It provides a solid base of facts and information about the impact of oil sands developments today and provides forecasts for the next five years within a longer term context. It also identifies current and anticipated gaps in infrastructure and services in critical areas including:

- Housing
- Transportation
- Basic municipal infrastructure – water treatment, waste water treatment and landfill
- Health care
- Education
- Social services
- Policing
- Environment

The report provides 30 recommendations to address the current and anticipated challenges surrounding oil sands developments and their impact on communities and on the province as a whole.

Highlights

Alberta's oil sands and oil sands related activities are a significant driver of economic activity in the province, and forecasts indicate that this will continue to be the case for the foreseeable future.

The pace of investment in Alberta's oil sands has grown substantially since the mid 1990s. And with continuing relatively strong prices for oil, a substantial level of investment is expected to continue for the next five years and beyond. The financial benefits to the provincial government and the continued contribution to the prosperity of Alberta are clear.

At the same time, the pace of growth has caused pressures on essential services and infrastructure, particularly in Fort McMurray. There are growing concerns with shortages of skilled labour to meet the needs of the oil sands and other industries, and with the impact of current and planned oil sands developments on Alberta's environment.

Forecasts for the next five years

- Future oil prices will sustain growth in the oil sands.

We expect oil prices to soften slightly, but remain sufficiently high (at around the \$55 US per barrel level for West Texas Intermediate) to sustain anticipated growth in the oil sands.

- The days of cheap oil appear to be a thing of the past. Oil prices are expected to stay sufficiently high over the medium term to continue to attract and maintain oil sands investment.
- The future growth of Alberta's economy will be heavily tied to energy production and development for many years to come. While conventional oil and gas production is declining, oil sands development is expected to continue at a brisk pace in the next five years and beyond. That means Alberta's future prosperity is closely tied to the wise development of its oil sands resources.
- Investment in the future of the oil sands is crucial for the continued prosperity of the province.

With anticipated declines in conventional oil production, oil sands are expected to make up 80 percent of total production by 2011. Estimates are that production will reach close to four million barrels a day by 2020.

- Although various sources of renewable energy are being developed and production of renewable energy is expected to grow, it is not likely that renewable energy sources could or will meet the growth in energy requirements. As a result, the world will continue to rely on fossil fuel sources over the next two decades and oil from Alberta's oil sands will continue to be in high demand.
- While much of the focus is on extraction and production of bitumen, steps need to be taken to maximize the return on the province's bitumen resource through enhanced recovery rates and upgrading into higher value products.
- Population in the oil sands areas will grow at different rates, with Fort McMurray continuing to be a high growth area. 'High growth' is defined as growth exceeding six percent per year, sustained over at least three years, and usually associated with isolated locations.
- With continuing strong growth in oil sands development, the population of Fort McMurray is forecast to grow at about eight percent per year for the next five years, well above the growth rates of other communities in the province. The population of the urban service area is projected to reach 95,000 by 2011. In addition, the population living in work camps could reach 14,000 to 15,000 people by 2011.
- The population of the Cold Lake – Bonnyville and Peace River regions are not expected to grow at rates anywhere near those in Fort McMurray. Their growth is expected to be similar to growth rates in many other communities across the province; however, this should be monitored carefully in order to anticipate and plan

ahead if there are major new developments that could lead to substantial spikes in population.

- Development in the Industrial Heartland northeast of Edmonton is occurring faster than anticipated. A substantial increase in the number of people working in the region is expected as upgrader projects ramp up over the next five to seven years. Expectations are that all or most of this labour force requirement can be absorbed from the surrounding Capital region. However, there is a clear need for more comprehensive planning for the region, particularly in relation to transportation and utilities.

Current and anticipated gaps in services and infrastructure

Based on our assessment of current services and infrastructure, we identified significant gaps in housing, health care, and basic infrastructure.

- The housing shortage is particularly acute in Fort McMurray and the shortage of affordable housing compounds the challenge of attracting and retaining the necessary workforce, particularly in the public sector -- teachers, police officers, social services workers, and health care providers. Provincial funding for affordable housing programs is not sufficient to meet the needs in the Fort McMurray area. There is sufficient land available for housing in Fort McMurray; but the Regional Municipality of Wood Buffalo does not have the capacity to complete the necessary planning processes in a timely fashion so that land can be sold, developed and housing constructed quickly.
- The ability of the Regional Municipality of Wood Buffalo to fund the critical infrastructure projects needed for water treatment, waste water treatment, and solid waste is in doubt. It also lacks the capacity to pay the up front costs to develop offsite infrastructure for new subdivisions. Without some form of special "bridge" funding from the provincial government, it is unlikely that these urgent needs can be met in the time frames required.
- Health services in the Northern Lights Health Region are inadequate to meet the needs of a rapidly growing population. Without significant investment in health planning, funding and capital spending, access to the necessary services for a population the size of Fort McMurray and surrounding communities will continue to be a serious challenge.
- Transportation issues are a growing concern in the Regional Municipality of Wood Buffalo. While the provincial government has committed to address a substantial portion of the transportation requirements, much of this still is in the design and planning stage and a significant portion remains unfunded.
- A number of social issues affect people in the Regional Municipality of Wood Buffalo including homelessness, addictions, and the lack of affordable and accessible child care.
- While there are some gaps in infrastructure and services in the Cold Lake – Bonnyville and Peace River regions, the gaps are not, for the most part, a direct result of oil sands development and current planning and funding mechanisms

should be sufficient to address expected population growth during the next five years.

- Satisfactory progress is being made in the delivery of policing and education services even though these services are operating near or at capacity. Plans for recreation and community facilities in Fort McMurray are also likely sufficient to meet the expected needs for the future, given major projects at MacDonald Island and Keyano College.
- Progress on some environmental issues is being delayed in part as a result of significant staff shortages in Alberta Environment and Alberta Sustainable Resource Development. These shortages have the potential to delay the processing of oil sands and other development applications and to adversely affect environmental planning, monitoring and enforcement.

Overall conclusions

Based on our assessment of available information and anticipated trends for the future, the report draws the following overall conclusions:

- The overall planning and decision-making process within the Alberta government is adequate in some respects and deficient in others.

Planning appears to be adequate for policing services, education, and recreational facilities. But that is not the case for housing, health care, basic municipal infrastructure, transportation, and social services.

Specifically, the team found that current funding formulae, especially in health care, do not work well in high growth areas. There isn't a common approach across government to preparing consistent population forecasts. Capital and operating funding requests are not clearly linked. While provincial government departments are doing a good job of monitoring social and economic conditions across the province, decision making within government needs to be better integrated. More needs to be done to address and manage environmental impacts, particularly cumulative effects over time.

The traditional method of allocating resources on an "equal" basis across communities and across services does not address the pressing needs of high growth areas.

- Coordination between the province and its agencies can be improved.

The province can do a better job of coordinating provincial decisions and policies and anticipating the impact on the health system, the education system, post-secondary institutions, policing, and social agencies.

- Provincial and municipal responsibilities and funding capacity do not always match.

Anticipated needs for basic municipal infrastructure and transportation in the Regional Municipality of Wood Buffalo exceed the capacity of the municipality to fund all projects out of their current sources of revenues in the near term.

- Fort McMurray is unique.

While there are growing demands in the Cold Lake – Bonnyville and Peace River regions, a number of factors make the situation in Fort McMurray unique. As a result, special attention, both in planning and in investment, is required to meet the needs in the Regional Municipality of Wood Buffalo. Comparing the population of the Regional Municipality of Wood Buffalo to the population of Alberta indicates that for every one dollar per capita “taken off the top” of the Alberta budget and dedicated to meeting the needs in the Regional Municipality of Wood Buffalo, it would reduce the per capita allotment to other Albertans by 2.43 cents, a small price to pay for future prosperity.

- The provincial government has special obligations.

In the hierarchy of necessary government services, health care and the provision of safe drinking water, waste water treatment and waste disposal rank very highly. The provincial government needs to focus additional attention and funding in these areas.

- Investment requirements include additional resources in some provincial government departments.

Additional staff is required to keep pace with growing pressures in high growth areas, especially in relation to environmental impact assessments, monitoring and enforcement. Adjustments to grant funding also are required to meet the needs of communities in high growth areas.

Recommendations

Part 1: Over-arching recommendations

RECOMMENDATION 1: The Alberta Government should place a high priority on the development of infrastructure necessary to support continued growth and development of the province’s oil sands resource. The returns from this investment can then be used to address future needs in Alberta.

RECOMMENDATION 2: The Alberta Government should develop policies and encourage research to promote enhanced oil recovery and increased value-added opportunities for its bitumen resource.

RECOMMENDATION 3: Provincial priorities should be set in a way that supports investments necessary to achieve future revenues and meet the business needs of the province.

RECOMMENDATION 4: Sustainable development should be considered a business need of the province.

RECOMMENDATION 5: Provincial government business planning for high growth areas should be separated from the regular government planning process. Additionally, there is a need:

- For planning to have a longer-term focus. The current three-year business planning process does not provide a sufficient time frame to address issues in high growth areas
- To ensure a coordinated decision-making process that considers all priority needs at the same time
- For one common population forecasting model, including demographics, designed to address planning needs in health, education, infrastructure, and other requirements. The results should be shared with municipalities, public agencies and the private sector
- To develop a set of reliable benchmark indicators for regional comparisons
- To develop one common data set where possible
- For government to involve municipalities, agencies and industry in the planning process. Industry needs to provide information regarding their development plans and the timing of development. In this regard, the RIWG approach is a positive approach to providing industry information in a coordinated fashion and should be encouraged in the other oil sands regions

RECOMMENDATION 6: The resource allocation process for high growth areas should be separated from the regular government budgeting system.

RECOMMENDATION 7(a): The role and mandate of the Oil Sands Ministerial Strategy Committee (Cabinet Committee) should be expanded to include:

- Management and direction of the provincial delivery of infrastructure and services to the Regional Municipality of Wood Buffalo
- Coordination of provincial, municipal and industry responsibilities for the planning, financing and delivery of infrastructure in the Industrial Heartland
- Monitoring other potential high growth regions
- Identification and resolution of any policy gaps and inconsistencies impacting oil sands development

RECOMMENDATION 7(b): The Chair should be a member of the Agenda and Priorities Committee of Cabinet and Treasury Board.

RECOMMENDATION 7(c): The Committee should be supported by a small Oil Sands Sustainable Development Secretariat (four to five people) headed by a Deputy Minister level appointment.

RECOMMENDATION 8: Attraction and retention allowances and benefits for government employees and its agencies need to be consistent. The Alberta Government should increase funding to public sector agencies to address this issue.

RECOMMENDATION 9: Industry should be expected to continue its policy of contributing to the community in substantial ways. New companies seeking approval for new projects should be advised of this expectation.

RECOMMENDATION 10: A substantial increase in manpower (FTE's) should be provided to Alberta Environment and Alberta Sustainable Resource Development to focus on cumulative effects, EIA's, research, policy development, monitoring and enforcement in the oil sands areas. Some new resources should also go to Alberta Health and Wellness to support the EIA process.

RECOMMENDATION 11(a): The July 10, 2006 draft of the Instream Flow Needs policy should be released officially and every effort should be made to complete, publish and enforce a water management scheme that will protect the ecological integrity of the aquatic ecosystem of the lower Athabasca River, to be implemented on a phased-basis beginning no later than July 1, 2007.

RECOMMENDATION 11(b): Alberta Environment should assign urgent priority to defining the water supply (both surface and groundwater) available for use in the Industrial Heartland area.

RECOMMENDATION 12: The provincial government should initiate an independent evaluation of the operations of the Cumulative Effects Management Association with a view to enhancing its efficiency and timeliness in developing recommendations. The review should address governance issues, types of decisions which need not be the subject of consensus, the adequacy of the regulatory backstop, and the resources required for CEMA to be more effective.

RECOMMENDATION 13: Priority should be assigned to completing current initiatives related to land use and cumulative effects planning, such as the Land Use Framework, the Integrated Land Management Program, the updating of the Regional Sustainable Development Strategy and associated regional planning tools, as well as the completion of the vision and strategies for oil sands development. Discussions concerning the requirements for reclamation should be concluded and policies clarified in a timely manner.

RECOMMENDATION 14(a): The Alberta government should continue to support projects related to carbon dioxide capture, transport and storage and in the use of carbon dioxide to enhance conventional oil recovery rates.

RECOMMENDATION 14(b): The Alberta government should develop a policy framework related to managing CO₂ emissions from oil sands projects as part of an overall initiative to address CO₂ emissions and enhanced oil recovery.

RECOMMENDATION 15: The provincial government should continue to support negotiations currently underway in an effort to provide certainty in the business environment surrounding the development of the oil sands in the Athabasca Oil Sands Region, to enhance the ability of First Nations and Métis to participate in the benefits of development, and to ensure fairness for all parties involved in that development.

RECOMMENDATION 16: The Alberta Government, in conjunction with the Regional Municipality of Wood Buffalo and industry, should undertake a feasibility study to determine the need for and the costs associated with development of a new town north of Fort McMurray.

Part 2 – Addressing Gaps in the Regional Municipality of Wood Buffalo/Fort McMurray Area

RECOMMENDATION 17(a): The capacity to undertake municipal planning processes must be enhanced. Any inability of the municipality to make timely planning decisions will further delay the development of sufficient housing stock to meet population growth. The province needs to assist the Regional Municipality of Wood Buffalo to put sufficient

experienced planning resources in place to increase the capacity to complete area structure plans in a timely manner.

RECOMMENDATION 17(b): If the area structure plan for Saline Creek is not completed in a timely manner, the province may wish to consider other options to speed up its completion. Effective, but somewhat unpalatable, options could include establishing deadlines, taking over the planning process itself and exempting the land from municipal approval requirements pursuant to section 618(4) of the Municipal Government Act. Alternatively, the province may choose to use its regulation-making authority under Section 694(5) of the Municipal Government Act to direct the municipality to take certain actions.

RECOMMENDATION 17(c): The province needs to ensure that provincially-owned land is released in a timely fashion to meet housing needs well in advance of actual requirements. In this regard, the Draft Land Release Strategy needs to be updated by the province and approved.

RECOMMENDATION 17(d): To ensure timely development, the province needs to continue the practice of placing conditions regarding the pace of development on land sold by the province.

RECOMMENDATION 17(e): The Regional Municipality of Wood Buffalo should complete area structure plans well in advance of the need for development. The municipality also needs to ensure timely issuance of permit approvals.

RECOMMENDATION 17(f): The municipality is faced with the need to provide up front investment for offsite infrastructure for the development of the Saline Creek area. Detailed estimates are not available; however, this could amount to \$125 million, or more. The province should provide the municipality with a means of bridging the up front costs until they are recovered from developers. In the case of the Saline Creek area, the provincial government should pay for the offsite servicing costs and recoup the funds as developers pay offsite levies to the municipality. This option would be open only to the Regional Municipality of Wood Buffalo as a high growth area. (The concept was previously employed under the now defunct Alberta Home Mortgage Corporation.)

RECOMMENDATION 18(a): For the 2007-08 and 2008-09 fiscal years a total of \$45 million per year should be allocated to provide 600 affordable housing units in Parcels D and F.

RECOMMENDATION 18(b): Timely decisions about the extent of affordable housing in Saline Creek, Willow Square and other areas need to be made and budgeted for following an evaluation of the effect of the provision of the 600 units in parcels D & F.

RECOMMENDATION 18(c): Alberta Infrastructure and Transportation needs to include provisions for land for affordable housing when the province sells the land in Saline Creek and other areas in the future.

RECOMMENDATION 19: Because of the importance of attracting new employees in the health, education and policing areas, a one year rent subsidy should be offered for those essential service employees who qualify for affordable housing. A budget of \$1 million

per year for three years is required, with priority to be based on lowest disposable income.

RECOMMENDATION 20(a): The Government of Alberta should provide expertise and resources to the Regional Municipality of Wood Buffalo to ensure timely completion of master plans needed to do proper long-term municipal planning.

RECOMMENDATION 20(b): The Government of Alberta should provide direct funding to the Regional Municipality of Wood Buffalo for basic municipal infrastructure through mechanisms such as conditional grants or loans which would require full or partial repayment (depending upon the extent of future municipal tax revenues) if and when potential municipal tax revenues materialize. Criteria should be developed to determine the circumstances in which these loans or grants would be forgiven or repaid. The criteria should be linked to the municipality's future repayment ability and should be conditional on the demonstration by the municipality that their tax policies and bylaws were appropriate, based on the circumstances facing the municipality.

RECOMMENDATION 21(a): Alberta Health and Wellness should become more directly involved in working with the Northern Lights Health Region to develop a vision and plan for medical services in the region that meet the needs of the residents.

RECOMMENDATION 21(b): A significant infusion of resources, both operating and capital, is required to avoid further deterioration and possible collapse of the system as growth continues in the area. A number of steps should be taken now to improve health care delivery in the short term, pending completion of a longer term vision and plan:

- Development and funding (capital and operating) of a continuing care and supportive living facility located outside the hospital which will free up space in the existing hospital for active care treatment.
- Creation and funding of adequate isolation rooms to deal with possible pandemics.
- Priority attention needs to be directed to the attraction and retention of health care workers in the Northern Lights Health Region. The provincial government should design and fund temporary salary and wage market modifiers for a three- to five-year trial period that would provide additional compensation to physicians, nurses and other specialized health care workers who are willing to locate in Fort McMurray.
- Immediate funding outside the current funding formula should be established to bring the standard of health care service in Northern Lights Health Region to acceptable levels. The requirement for a recovery (deficit elimination) plan to address the current deficit should be suspended until acceptable service levels are reached.
- Alberta Health and Wellness and Northern Lights Health Region need to engage in a process to reconcile health care registration numbers with municipal census data on an annual basis and adjust base funding for the region accordingly.
- Area structure plans should reserve land for future medical sites in accordance with the agreed upon vision.
- Immediate funding should be allocated to build a parkade at the current hospital site. Access for helicopter cases (medivac) would be improved by a heli-pad on top of the parkade.
- Given the high turnover of senior staff and the complex process for obtaining capital approvals, ways should be found to expedite relatively simple capital requests, such as the parkade and the interim ambulatory care re-development program.

RECOMMENDATION 22(a): The province should ensure that the school boards' future planning and Alberta Education's vision as outlined in *Schools for Tomorrow* are coordinated.

RECOMMENDATION 22(b): Operating and capital funding should be provided by the province to meet the projected future growth of student enrolments, which may come quickly from the increased availability of housing.

RECOMMENDATION 23(a): Alberta Infrastructure and Transportation should establish as its priority the required transportation improvement projects north of the Highway 63 and 881 intersection.

RECOMMENDATION 23(b): Until such time as Highway 63 south of the 881 intersection can be twinned, passing lanes and staging areas need to be developed to increase safety on this section of highway.

RECOMMENDATION 23(c): Alberta Infrastructure and Transportation should consider a longer timeframe for the twinning of Highway 63 south of the 881 intersection in favour of earlier work on the four major interchanges within the urban service area.

RECOMMENDATION 23(d): The \$150 million east Athabasca corridor road requested by RIWG should be considered an industrial road used principally for industry access to oil sands projects and therefore should be funded entirely by industry.

RECOMMENDATION 23(e): Alberta Infrastructure and Transportation should set target completion dates for major provincial highway projects within the Regional Municipality of Wood Buffalo to assist the municipality in coordinating their own municipal road projects.

RECOMMENDATION 23(f): An airport master plan should be developed for the Regional Municipality of Wood Buffalo to coordinate future development of private and public airports.

RECOMMENDATION 24(a): Alberta Seniors and Community Supports should provide funding for Marshall House's proposed operating expenses.

RECOMMENDATION 24(b): If the pilot project to help the homeless with the skills and services they need to become more independent and the transition to other housing options is successful, Alberta Seniors and Community Supports should consider ongoing support for the program as a way to address the homeless issue.

RECOMMENDATION 25: The provincial government should work with the municipal government, community groups and industry to provide more affordable quality child care in the region. Consideration should be given to enhanced child care subsidies for low income families as a mechanism to promote affordable child care in high growth areas such as Fort McMurray.

RECOMMENDATION 26: Initiatives related to issues such as affordable housing, child care shortages, health care issues and workforce shortages should be continued with a view to reducing family stress and the accompanying need for support services.

RECOMMENDATION 27(a): The provincial government should continue to pressure the federal government to increase pay scales for RCMP officers in the Regional Municipality of Wood Buffalo as a means of improving recruitment and retention.

RECOMMENDATION 27(b): The provincial government should provide funding to support a province-wide program, with full-time staff, to provide tactical teams that can deal specifically with drug problems in the Fort McMurray region. The program should initially be available to Fort McMurray on a regular basis and should eventually result in a team or teams deployed in Fort McMurray.

RECOMMENDATION 27(c): The provincial government should commit funding to share the costs of construction of a combination storefront policing/cell block/remand centre in downtown Fort McMurray.

Part 3 – Addressing Gaps in Cold Lake – Bonnyville and Peace River Areas

RECOMMENDATION 28(a): The Oil Sands Ministerial Strategy Committee and the Oil Sands Sustainable Development Secretariat should be charged with careful monitoring of growth and growth trends in the Cold Lake – Bonnyville and Peace River areas. Should population forecasts indicate that levels of ‘high growth’ (at least six percent per year) will be sustained over at least three years, government planning and budgeting for these areas should be done in the same way as recommended for the Athabasca oil sands area.

RECOMMENDATION 28(b): The provincial government should deal with issues related to rural/urban revenue and cost sharing in the Cold Lake – Bonnyville and Peace River areas. As growth continues, these will become ever larger issues.

RECOMMENDATION 28(c): The provincial government should review the criteria and funding under the Resource Road Program to ensure it meets the needs of the Peace River and Cold Lake – Bonnyville regions. The province should also extend the program beyond its current 2008-09 end date.

Part 4 – Addressing Gaps in the Industrial Heartland

RECOMMENDATION 29: Alberta Infrastructure and Transportation should immediately join with the respective municipalities and industry to develop a comprehensive transportation and utility plan for the Industrial Heartland, including identification of any needed funding. This needs to be done on an urgent basis.

Part 5 – Next Steps

RECOMMENDATION 30: To follow up on this report, a short-term action plan for sustainable development coordination should be developed and should include:

- Appointment of an Acting Oil Sands Sustainable Development Coordinator pending recruitment of a full-time coordinator
- Vetting of this report with departments, with affected municipalities and with industry
- Development of a more accurate costing of recommendations
- Review of these recommendations in the light of Premier Stelmach’s pledge to provide additional annual funding to municipalities

- Development of a practical and fiscally responsible timing and phasing of the actions resulting from these recommendations
- Preparation of a Ministerial Request for decision on budgets and timing
- Approval by the Cabinet Committee and Cabinet

Part 6 – Costing of recommendations

In the time available to prepare this report, it was not possible to do a detailed costing analysis of recommendations or the actions necessary to address current and anticipated gaps. As noted above, a detailed costing should be done as a first priority for moving forward. Overall, the average annual additional capital commitment is estimated to be in the range of \$85 million per year over the next five years, excluding the costs of additional health facilities yet to be developed.

Part 7 – Outstanding policy issues

In addition to the specific recommendations, the report also identifies a number of outstanding policy issues to be addressed, including:

- Considering alternative ways of resolving rural-urban cost and/or revenue sharing issues
- Addressing the federal government's contributions to support development in the oil sands. As the largest beneficiary of Alberta's oil sands, the federal government's contribution to necessary infrastructure development does not match the benefits it receives.
- Identifying new sources of revenues for municipalities in high growth areas and addressing legislative and policy changes impacting municipalities
- Addressing the cumulative effects of oil sands developments on the environment and expanding the province's capacity to analyze, manage, monitor and make decisions on a timely basis
- Considering the role of AEUB in policy making.

Introduction

The tremendous pace of growth in the oil sands over the past few years, particularly in the Fort McMurray area, has provided many benefits to the province. Alberta's economy leads the country in growth and the provincial government's revenues have grown substantially.

At the same time, the pace of growth has also caused stresses and strains in the province, particularly on infrastructure, housing and transportation. Increasing concerns are being raised about the impact of growth on the environment. There are serious labour force shortages in many parts of the province. And in Fort McMurray, the community itself is hard-pressed to keep up with growing demands for housing, transportation, health care and education.

Given the challenges we see today, the Oil Sands Ministerial Strategy Committee of the provincial government was directed by Cabinet to develop a coordinated short-term action plan to address the social, environmental and economic impacts of oil sands development in local communities.

This report is designed to support that initiative and to provide a foundation of facts and information about oil sands developments today and the most likely forecasts for the next five years.

Specifically, the objectives of this report are to provide:

- A realistic growth forecast for the next three to five years for the oil sands in consultation with government departments and industry
- An assessment of current and anticipated gaps in core government services resulting from pressures related to oil sands development
- Recommendations on a coordinated plan to remedy the gaps
- A summary of short-term policy issues that require government resolution in order to more effectively manage growth and development, as well as options for action.

To achieve those objectives, a small team of people was set up under the direction of the Chair of the Ministerial Strategy Committee.

The approach focused primarily on reviewing existing reports and plans as well as consulting with government departments, industry, municipalities, Aboriginal representatives, and non-government organizations. Public and private forecasts were reviewed along with government business plans, the current capital plan, and relevant government planning documents. A complete list of the various organizations consulted during the process is included in Appendix 2.

The team reviewed a wealth of information from government departments, industry, municipalities, and organizations such as: Canadian Energy Research Institute (CERI); The Conference Board of Canada; Alberta Energy and Utilities Board (AEUB); National Energy Board (NEB); Canadian Association of Petroleum Producers (CAPP); United

States Energy Information Administration; and the Athabasca Regional Issues Working Group Association (RIWG).

To further enhance our work, the team contracted with CERI to evaluate the economic impacts of Alberta's oil sands developments on Alberta's economy, the Canadian economy and, to the extent practical, on the economies of the three oil sands regions. As well, we contracted with Nichols Applied Management to undertake population forecasts for the Cold Lake – Bonnyville and Peace River oil sands regions and an analysis of labour requirements for the Industrial Heartland. The Nichols Applied Management population model was used to forecast the population within the Regional Municipality of Wood Buffalo. Additionally, we would like to acknowledge the information and data provided from a number of sources within the Alberta government.

The data used by RIWG to prepare the Wood Buffalo Business Case and the *Update and Progress Report document, December 2005* is based on confidential company data collected by CAPP. As part of the study team's due diligence process, Deloitte Inc. was engaged to undertake a review of the confidential data and to determine if it was used in an appropriate manner to generate the reports prepared by RIWG. The report prepared by Deloitte Inc. confirmed that, "... the forecasts for capital expenditures, bitumen production, revenue to government t¹, hiring intentions and population presented by RIWG in the Wood Buffalo Business Case 2005 and the related December 2006 update, fairly represents the industry outlook for oil sands projects either currently in operation or planned for development through the year 2010."²

Given the short-time lines involved, the study team worked primarily from information readily available from existing sources. The result is a comprehensive report outlining the current context, our forecasts for oil sands developments, existing and anticipated gaps in essential services and supports, as well as recommendations for a pro-active and focused planning effort to anticipate and manage growth in Alberta's oil sands.

Acknowledgements and further comments on the methodology for this report are included in Appendix 1.

¹ Speaking about the revenue analysis, Alberta Energy advises that RIWG processes aggregate individual company confidential forecasts that cannot be verified. Similar aggregated forecasting for royalties done by Alberta Energy, under some scenarios of similar price assumption, tend to forecast lower government revenues.

² December 6, 2006 letter from Deloitte Inc. to Mr. Doug Radke, Coordinator.

Setting the context

It's important to begin with a clear picture of Alberta's oil sands today including the scope of oil sands developments, where they are located, how oil sands projects are approved for development, and what the oil sands mean for Alberta.

What are the oil sands?

The history of Alberta's oil sands dates back to 1719 when a member of the Cree First Nation brought a sample of oil sands to Fort Churchill. Explorer Alexander Mackenzie provided the first recorded description of the Athabasca oil sands back in 1790. Canada's first Geological Survey in 1875 noted an observation of water washing oil out of the oil sands and a man named G.C. Hoffman was the first to successfully separate bitumen from the oil sands.

In 1923, Dr. Karl Clark built the first oil sands separation unit in the basement of the University of Alberta power plant. Work continued on developing the technology and the first large-scale commercial plant was built in 1964 north of Fort McMurray. In 1974, the Alberta Oil Sands Technology Research Authority was established to invest in research to improve the techniques for extracting oil from the oil sands. This work was subsequently taken over by the Alberta Energy Research Institute, established in 2000.

Developments in the oil sands ramped up considerably in the late 1990s and early 2000s and today, the oil sands are recognized as an important driver of Alberta's economy.

In the past, most of Alberta's oil production was focused on conventional crude oil. But the reserves of Alberta's conventional crude oil are declining and the focus has shifted to the oil sands as the next big source of oil to meet growing international demands.

The oil sands contain the second largest oil reserve in the world, second only to Saudi Arabia. Unlike conventional crude oil, bitumen in Alberta's oil sands is a thick, tar-like substance that does not flow to a well. It takes about two tonnes of oil sands to produce a barrel of oil.

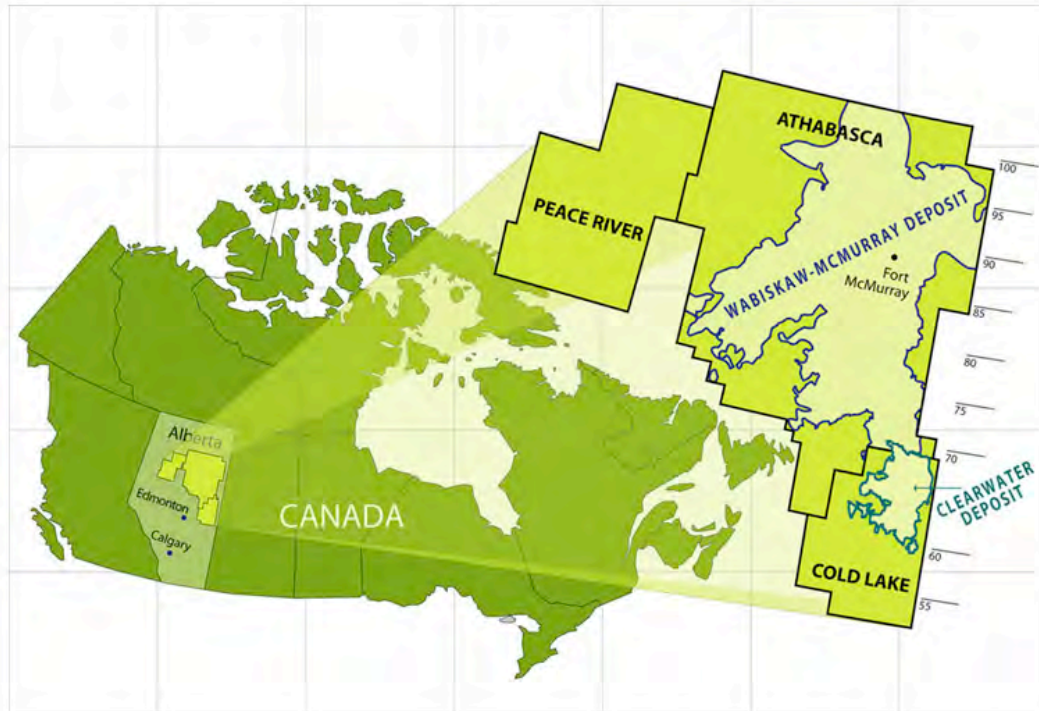
Several technologies are used to extract the bitumen from the sand. Where crude bitumen is located close to the surface, the oil sands are excavated and the bitumen is extracted from the mined materials. For oil located deeper underground, steam or solvents are injected into the reservoir to mobilize the bitumen and allow it to be pumped to the surface. New technologies are being developed to reduce the amount of water used and greenhouse gas emissions produced and also to test alternative sources of energy for powering the massive oil sands developments.

While much of the focus is on oil sands located in the Fort McMurray area, in fact, Alberta has three designated oil sands areas:

- Athabasca Wabiskaw-McMurray – contains about 80 percent of the oil reserves
- Cold Lake Clearwater deposit – contains close to 12 percent of the reserves
- Peace River deposit – contains about eight percent of the reserves

In total, these three oil sands areas underlie about 140,800 square s of land in northern Alberta.

Figure 1: Alberta's Three Oil Sands Areas



Source: AEUB ST98 - 2006

The subsequent chapter provides more detailed information about the scope and size of the oil sands, but the following key points provide an important perspective.

- While conventional oil has been an important driver of the provincial economy in the past, and will continue to be in the future, non-conventional oil will be vital to our province's future growth and prosperity.
- In 1996, conventional oil accounted for about 70 percent of total production in Alberta and non-conventional production accounted for only 30 percent. By 2011, conventional crude will make up only 20 percent of production and bitumen will account for 80 percent.
- Current estimates are that 178 billion barrels of oil can be extracted from Alberta's oil sands under today's economic conditions and using existing technology. But this represents only 11 percent of the total reserves in the oil sands. About 315 billion barrels of oil are ultimately recoverable from the three oil sands regions.
- Production of oil from the oil sands has increased substantially. In 2004, production reached one million barrels per day. Estimates are that production will increase to 3.8 million barrels per day by 2020.
- Close to 70 oil sands projects are currently underway and more are in the planning and development stages.

Upgrading oil from the oil sands Opportunities in the Industrial Heartland

There is tremendous opportunity to not only extract bitumen from the oil sands but also to transform it into higher-value products such as synthetic crude oil, gasoline, diesel and other transportation fuels, lubricants, and petrochemical products. Currently, most of this 'upgrading' is done in the Fort McMurray area. In the future, an increasing portion will be done in the area northeast of Edmonton in what is called the "Industrial Heartland." The area includes the counties of Strathcona, Sturgeon and Lamont and the City of Fort Saskatchewan.

All indications are that the Industrial Heartland represents a major opportunity for upgrading and value-added activities in Alberta. Seven different companies have announced plans for construction or expansion of upgraders. The provincial government is actively promoting other secondary and tertiary industries in the area.

Potential upgraders include Shell Scotford, BA Energy, Northwest, Synenco, Petro Canada, Total, and North American Oilsands. The Shell Expansion and BA's plant are already under construction. There are opportunities for other companies to focus on the recovery of ethane/ethylene and propane/propylene liquids for petrochemical feedstocks, recycling and treatment of spent catalyst, diluent, metallurgy, fertilizer, and more.

The Industrial Heartland has some advantages over Fort McMurray when it comes to attracting these upgrading and value-added industries. Because labour is more readily available from all parts of metropolitan Edmonton and people can live in permanent rather than temporary housing, the necessary labour supply will be easier to access and more stable. Construction logistics and access to manufacturers and other suppliers are simpler in the Industrial Heartland. And other infrastructure such as rail transportation and some pipelines already exist and can be more easily expanded.

These advantages point to substantial investment and developments in the next few years.

Although the Industrial Heartland is not included in the terms of reference for this study, it will have a significant impact on Alberta's economy, rapid growth is anticipated, and the area may benefit from lessons learned in the three oil sands regions. As it stands today, industry does not believe that the province has been sufficiently active in planning and responding to infrastructure requirements to support such a massive development.

According to the Alberta Industrial Heartland Association:

- Current planning and funding mechanisms do not meet Heartland needs
- The resource road program is not equipped for the scale of development and multiple projects
- The traditional three – five year planning horizon will not meet the needs for traffic build up for projects already started.³

³ Meeting with the Alberta Industrial Heartland Association November 9, 2006.

The province has no provisions in the current capital plan for developing provincial roads concurrently with Strathcona and Sturgeon county municipal road plans.

This points to a clear need for the province to play a more active role in anticipating and planning for developments in the Industrial Heartland, along with the three counties involved and industry partners.

What do the oil sands mean for Alberta?

Economic benefits

The provincial government, communities and individual Albertans benefit directly and indirectly from developments in Alberta's oil sands.

The oil sands industry is a major driver of economic activity in the province and the pace of investment has been accelerating since the mid 1990s. From 1995 to 1999, investment averaged \$1.47 billion per year but from 2000 – 2004, that jumped to an average of \$5.75 billion per year. In the past two years (2005 and 2006), investment averaged \$10.3 billion per year. As explained in the subsequent section, that level of investment is expected to continue for the next five years.

Developments in the oil sands translate into a number of benefits for the province. In terms of royalties, the provincial government received close to \$4.45 billion in royalties from 1995-96 to 2005-06.⁴ In addition to royalties, the provincial government also receives tax revenues from corporate income taxes, personal income taxes from people working in the oil sands, and indirect corporate and personal income taxes. Municipalities in the oil sands regions and elsewhere also receive property tax from industries located within their jurisdiction.

The oil sands, and spin off industries related to the oil sands, are one of the largest sources of employment in the province. As a result, Alberta's unemployment rate is among the lowest in the country and the supply of skilled and unskilled labour is not sufficient to meet demands. This challenge will become even greater when major projects in the Industrial Heartland begin to increase the pace of construction.

Industry contributions

Over the years, industry has provided significant support to the infrastructure in and around Fort McMurray. In the 70s, Syncrude built entire neighborhoods and other infrastructure for its employees, including the construction of the Thickwood Heights Arena. They built the Ralph Steinhauer Bridge that spans the Athabasca River. This construction activity represented some \$300 million at the time and would be valued at over \$1 billion dollars today. Syncrude has continued its contributions in more recent times, the latest being a \$2.5 million Syncrude Canada contribution to the Athletic Park.

Suncor's predecessor, Great Canadian Oil Sands, supplied homes for its employees, support for recreational infrastructure and some contributions toward roads. Suncor's recent community investments include more than \$9.7 million to charitable organizations

⁴ Alberta Oil Sands Consultations fact sheets available at www.oilsandsconsultations.gov.ab.ca

in the Regional Municipality of Wood Buffalo and \$7.2 million pledged to 2010 for recreational, educational and medical causes. Suncor has also committed to the construction of an overpass on Highway 63. The overpass is expected to cost between \$30 and \$40 million and will serve their mine and upgrader facilities.

In 2005, total corporate donations to support community projects amounted to \$6.3 million, of which \$3.8 million came from Suncor. Cumulative contributions since 1996 exceed \$40 million.

While recent corporate donations are commendable, they don't approach the value of industry contributions made in the early days of oil sands development. And the majority of the recent contributions are still being made by two companies. "Newcomers" to oil sands development in the Athabasca oil sands area, although they are now beginning to contribute to the community, have not stepped up to the plate in the same way that Syncrude and Suncor have done over the years.

Environmental impact

While the benefits are enormous, the impact on the environment is undeniable. The key issues relate to the amount of surface and ground water used in the extraction process, the overall impact on the quality of surface and ground water, levels of greenhouse gas and other air emissions, land disturbance and the size of the footprint on the land base, land reclamation, and impacts on wildlife and endangered species. While these issues affect all three oil sands regions, the biggest challenges are in the Athabasca oil sands region due to the current and anticipated level of development in the area. The environmental impact, and how it is being addressed, is discussed in greater detail in section five of this report.

How are projects approved?

Extensive processes are in place to review oil sands projects before they can proceed. The processes involve the following steps:

- Securing a lease from the provincial government
- Assessing the environmental impact of proposed projects
- Obtaining approval from the Alberta Energy and Utilities Board
- Obtaining approval from Alberta Environment.

Securing a lease

The provincial government owns 81 percent of the province's mineral rights in Alberta. The remainder is held by individuals and companies ('freehold mineral rights') or by the federal government either in national parks or on behalf of First Nations.⁵

Alberta Energy administers mineral rights on behalf of Albertans. Every two weeks, Alberta Energy holds a public offering for companies who are interested in bidding on

⁵ Information about leases is taken primarily from background information prepared for the Alberta Oil Sands Consultation. Further information is available at www.oilsandsconsultations.gov.ab.ca.

Crown leases on specific parcels of land. The company with the highest bid wins the right to “drill for, win, work, recover and remove” minerals that are owned by the Crown.

Companies that bid on mineral rights must be registered to do business in Alberta. The names of winning bidders and the amount paid for each parcel of land are published on the department’s website after each sale.

The department holds an average of 24 public offerings a year and, over the past five years, an average of 220 oil sands agreements have been issued each year.

Currently there are close to 3,000 oil sands leases in place covering approximately 47,000 square km of land. Close to 70 percent of possible oil sands areas are still available for exploration and leasing.

Environmental assessments

In Alberta, an extensive environmental assessment process is required before major projects can proceed. For oil sands projects, an environmental assessment is mandatory. For other projects, steps are taken to decide whether or not an environmental assessment is necessary. Routine or small projects are generally exempt from the process.⁶

The purpose of the Environmental Assessment Process is to:

- Support the goals of environmental protection and sustainable development
- Integrate environmental protection and economic decision making at the earliest stages of development
- Predict the environmental, social, economic and cultural consequences of a proposed activity and assess plans to mitigate any resulting adverse impacts
- Involve the public, proponents and government departments and agencies in the review of proposed activities.

The process involves four stages:

- **Stage 1 – Initial review**

The process begins when the proponent for the project informs Alberta Environment of the proposed development. The location, size and nature of the project are examined as well as other factors to determine whether or not an environmental assessment is required. If an environmental assessment is not required, the proponent can apply for approval and the project can proceed. If an environmental assessment is required, as is the case for oil sands projects, the proponent of the project must provide public notice of that decision.

- **Stage 2 – Screening**

Based on a screening report, a decision is made about whether an Environmental Impact Assessment (EIA) is required for projects where an EIA is not mandatory.

⁶ Further information about the Environmental Assessment Process is available on the Alberta Environment website at www.gov.ab.ca.

This report is public. If an EIA is not required, the proponent of the project can proceed. If an EIA is required, that work begins.

- **Stage 3 – Preparation of an Environmental Assessment Report**

The proponent of the project proposes the terms of reference for what will be included in the EIA and this is made public for review. After allowing time for public comments, the Alberta Environment Director issues the final terms of reference which the proponent must use. This is also made public. The information to be included in an EIA can vary, but it typically includes potential positive and negative environmental, social, economic and cultural impacts of the proposed activity as well as plans to mitigate potential adverse impacts and to respond to emergencies, information on public consultation programs, and identification of health issues. The EIA must be submitted to the Director for review.

- **Stage 4 – Final review**

The Director and staff of Alberta Environment, in conjunction with other relevant government departments, review the EIA report and may request additional information. Because of the extensive amount of work involved in evaluating and assessing EIAs, a third party contracting approach has recently been developed by Alberta Environment to undertake some EIAs. This involves industry paying for independent, third party consultants to conduct EIA reviews, attend hearings, and review approvals for some applications. Alberta Environment will continue to oversee all applications and make the necessary decisions related to applications. The final EIA report is made public.

If concerns are filed by an adversely affected party, a public hearing may be triggered, in which case, other parties may also participate in the hearing process. The AEUB then makes a decision about whether the project is in the public interest. This decision is made after considering social, economic and environmental impacts associated with the proposed project. If approval is granted by the AEUB, Alberta Environment then decides whether environmental approvals should be granted. If environmental approvals are granted, they will include conditions to mitigate potential negative impacts of the project.

In summary

Some key points are obvious from the overall context for oil sands developments in Alberta.

- The oil sands are, and will continue to be, an important driver of economic development in the province.
- The financial and economic benefits to the province are enormous. Without the oil sands, it's fair to say that Alberta would be in a much less prosperous position and less able to provide key investments in important areas such as health, education and infrastructure.
- In spite of the benefits, there are negative impacts on Alberta's environment – on our air, land and water – that will need increased attention and action in the coming months and years.

- There are clear and deliberate processes in place for reviewing and approving oil sands projects and expansions. Those processes involve both mineral leases and environmental impact assessments.
- Planned developments in the Industrial Heartland will require careful planning to anticipate and prepare for the impact on infrastructure, communities and the environment in the region.

Projecting future growth

The approach

In order to assess the potential gaps in infrastructure and essential services in the three oil sands areas, it's important to begin with projections of future growth.

The focus is primarily on the next three to five years, from 2006 to 2011. At the same time, in order to understand and evaluate growth prospects in the proper context during this period it is necessary to look at the longer term. Hence the need to assess oil sand growth prospects out to 2020.

Given the short timelines for preparing this report, we relied on several recent reports and documents prepared by a number of organizations. A complete list of the various reports and information sources is provided in Appendix 2.

Based on the studies we reviewed and our own analysis, the following section provides a forecast of expected population growth for the three oil sands areas as well as estimates of oil sands capital expenditures, production volumes, royalty and tax revenue, and employment. A forecast of increased labour requirements for the Industrial Heartland was also undertaken. However, time did not allow us to extend the labour requirement for the Industrial Heartland into population forecasts for the entire region. Moreover, the capacity of the Capital Region to absorb the increased workforce is much greater than the capacity of any of the three oil sand regions to meet the needs of a large workforce influx.

Where do we stand today?

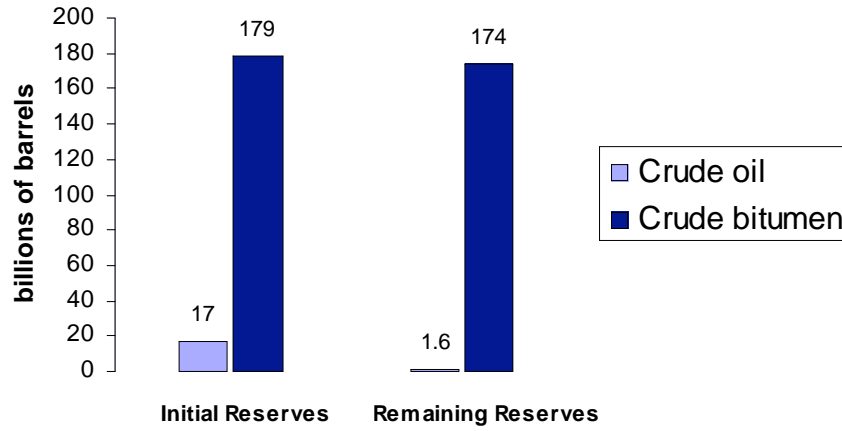
Canada's Place in the World Energy Industry

Canada is blessed with an abundance of energy resources and is a significant player in the global energy industry. It is the world's third largest producer of natural gas and the eighth largest producer of crude oil. The energy industry plays an important role in the Canadian economy, providing a major source of revenue to federal, provincial and municipal governments as well as generating wealth for investors and employees.

The majority of Canada's energy resources are found in the province of Alberta. The Alberta oil sands are among the largest deposits of crude bitumen in the world with an initial in-place volume of approximately 1.6 trillion barrels. The Alberta Energy and Utilities Board (AEUB) estimates about 11 percent or 178 billion barrels is recoverable under current economic conditions using existing technology. This represents enough supply to satisfy Canadian demand for crude oil for about 250 years.

About 315 billion barrels are ultimately recoverable from the three oil sands regions. Figure 1 provides some perspective on the importance of the oil sands resources to Canada's crude oil reserves. Crude bitumen reserves are more than 100 times larger than Canada's conventional crude oil reserves.

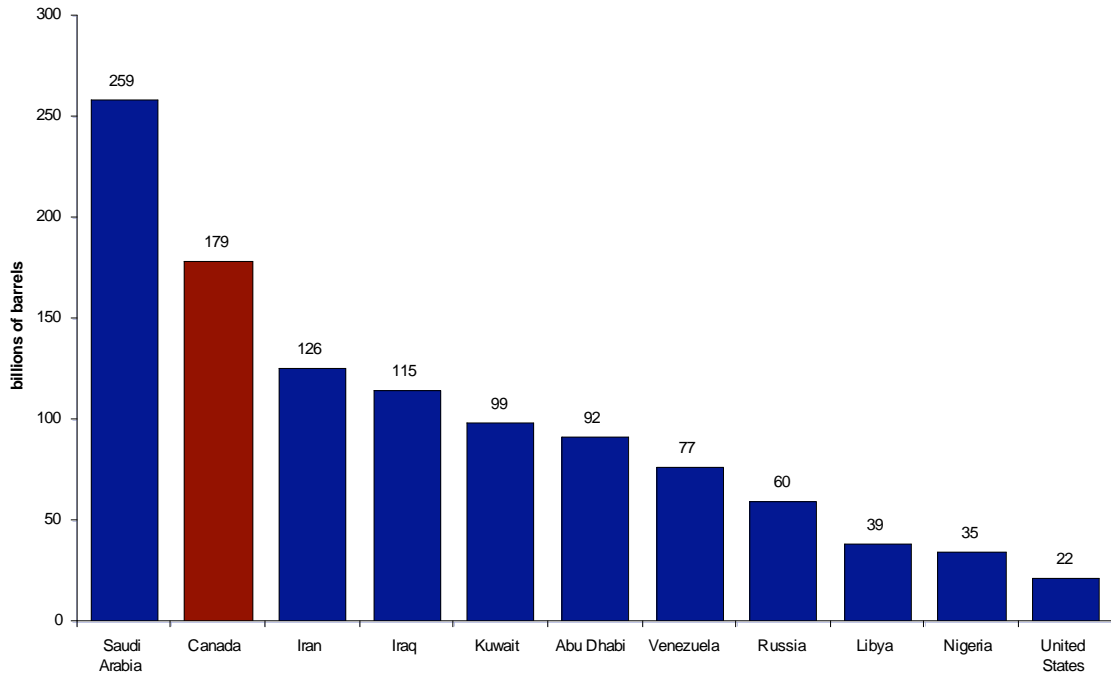
Figure 2: Crude Oil and Crude Bitumen Reserves



Source: EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook 2006-2015

The AEUB estimate of Alberta's oil sands reserves was recognized in 2004 by the US Department of Energy, securing Canada's place as a major player in the global energy industry. Internationally, the estimates of Canada's crude oil reserves jumped virtually overnight from approximately 1.6 billion barrels of conventional crude oil to 179 billion barrels of conventional and non-conventional crude oil. This puts Canada second only to Saudi Arabia in proven oil reserves.

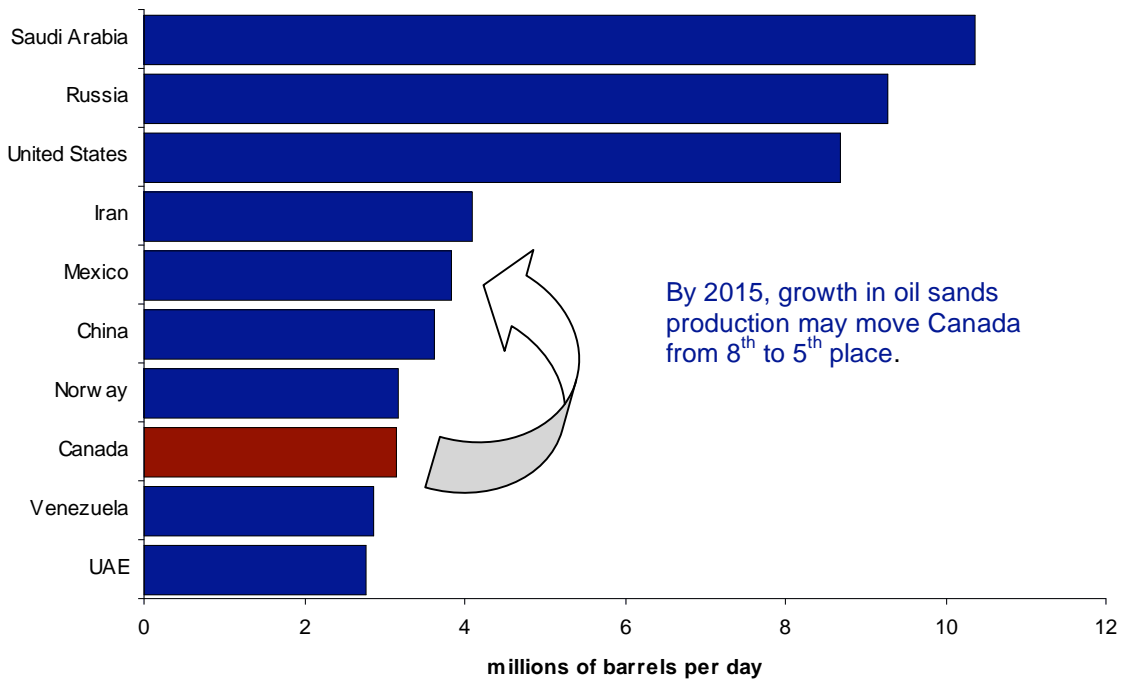
Figure 3: Crude Oil Reserves by Country



Source: Oil and Gas Journal Dec, 2004

Canada currently ranks eighth among the top ten world crude oil producers in 2004. Given the current level of oil sands development, Canada's ranking is expected to increase to fifth place by 2015 as a result of increased production from Alberta's oil sands.

Figure 4: Crude Oil Production by Country



Source: Energy Information Administration/Infoplease.com/CAPP

Alberta's Energy Reserves

The province of Alberta produces more than 65 percent of Canada's total energy production. Most of Canada's oil and gas fields, as well as the majority of coal mines, are located in Alberta. Table 1 provides a summary of the reserves and production of Alberta's energy resources. It shows that a substantial portion of the initial established reserve of crude oil and natural gas has already been produced, leaving just 9.4 percent of the initial established crude oil and 24 percent of the initial established reserve of natural gas remaining (not including new finds). This highlights the importance of the province's crude bitumen resource to Canada's energy future since only 2.8 percent of its established reserve has been produced.

Table 1: Alberta Energy Reserves and Production

	Crude Bitumen (billion barrels)	Crude Oil (billion barrels)	Natural Gas* (trillion cubic feet)	Coal (billion tons)
Initial in place	1694	64.7	279	103
Initial established**	179	17	166	38
Cumulative production	5	15.4	126	1.39
Remaining established	174	1.6	40	37

*Includes coal bed methane

**Does not include new finds

Source: EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook 2006-2015

Alberta's oil sands are contained in the Athabasca, Cold Lake and Peace River regions and cover an area of approximately 140,800 square km, primarily in northern Alberta. About 20 percent of Alberta's bitumen is surface mineable while 80 percent will require in situ recovery methods such as Steam Assisted Gravity Drainage (SAGD) or Cyclic Steam Stimulation (CSS).

Currently, there are about 3,000 oil sands lease agreements with the provincial government, totalling 49,000 square km. Approximately 97,000 square km or 69 percent of leasable oil sands areas are still available. However, on a volume basis, about 95 percent of the surface mineable reserve and roughly 47 percent of the in-situ reserve are currently leased.

Of the three oil sands areas, the Athabasca region contains the largest bitumen deposit, accounting for 1.4 billion barrels or 80.9 percent of the province's bitumen reserves. The Cold Lake and Peace River regions are considerably smaller and contain 11.5 percent and 7.6 percent of the bitumen reserve respectively.

Table 2: Initial In-place Volumes of Crude Bitumen

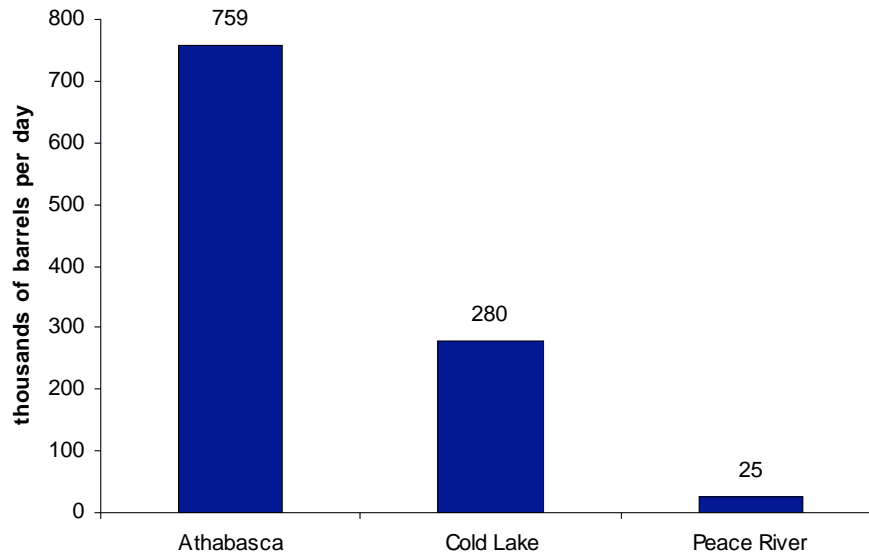
Oil Sands Area	(000s) of barrels	Percentage of in-place volumes
Athabasca		
Grand Rapids	54,585	3.2
Wabiskaw-McMurray (mineable)	101,187	6.0
Wabiskaw-McMurray (in situ)	831,085	49.1
Nisku	64,976	3.8
Grosmont	317,645	18.8
Subtotal	1,369,478	80.9
Cold Lake		
Grand Rapids	108,842	6.4
Clearwater	59,264	3.5
Wabiskaw-McMurray	26,965	1.6
Subtotal	195,072	11.5
Peace River		
Bluesky-Gething	62,435	3.7
Belloy	1,774	0.1
Debolt	49,062	2.9
Shunda	15,788	0.9
Subtotal	129,058	7.6
Total	1,693,608	100

Source: EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook 2006-2015

Crude Bitumen Production

Oil sands production reached one million barrels/day in 2004. Figure 4 indicates that most of the bitumen production (71 percent) is coming out of the Athabasca region, with 26 percent from the Cold Lake area and 2.3 percent from the Peace River region. Mining operations account for roughly two-thirds (600,000 bpd) of the total production, with in situ operations accounting for roughly one-third (380,000 bpd). Of the in situ production, approximately two-thirds (270,000 bpd) were recovered through thermal methods and one-third (110,000 bpd) through primary ("cold") production.

Figure 5: Bitumen Production 2005

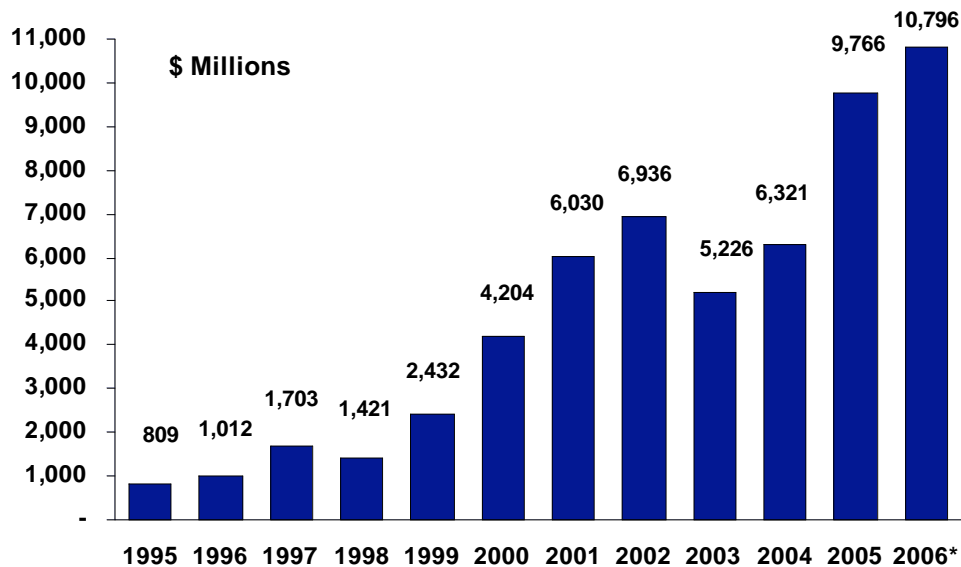


Source: EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook 2006-2015

Current Developments

Oil sands industry expansion is a major driver of economic activity in Alberta. Oil sands projects account for \$90 billion of the \$146 billion in investments listed by Alberta Economic Development in its *Inventory of Alberta Major Projects*. Since 1995, approximately \$45 billion dollars has been invested in oil sands development. Canada represents a stable place to invest. Investment opportunities are limited in a number of countries due to risks associated with political instability or state ownership and control of the industry. Figure 6 shows the rapid increase in oil sands investments since 1995. A list of major oil sands projects is included in Appendix 3.

Figure 6: Oil Sands Investment



Source: Statistics Canada/Alberta Economic Development

Longer-term prospects

Alberta's oil sands provide a tremendous opportunity for developing low value bitumen into higher value-added products such as synthetic crude oil, gasoline, diesel and other transportation fuels, lubricants, and numerous petrochemical products. A number of ancillary products are also derived from extraction and refining of bitumen including sulphur, titanium and petroleum coke. Developing and engaging in these value-added activities would further diversify Alberta's energy sector and expertise, and our economy.

The Alberta government and industry, through the Hydrocarbon Upgrading Task Force, have developed a vision for upgrading bitumen from the oil sands deposits. The vision states that, "Alberta will achieve a competitive hydrocarbon upgrading industry through refining and petrochemical plants that expand the market for Alberta's bitumen resource and produce higher value products in Alberta." (Source: Alberta Economic Development) The vision would see production of three million barrels per day by 2020 with one million barrels per day for upgrading to finished products. By 2030, production would increase to five million barrels per day with two million barrels per day for upgrading to finished products.

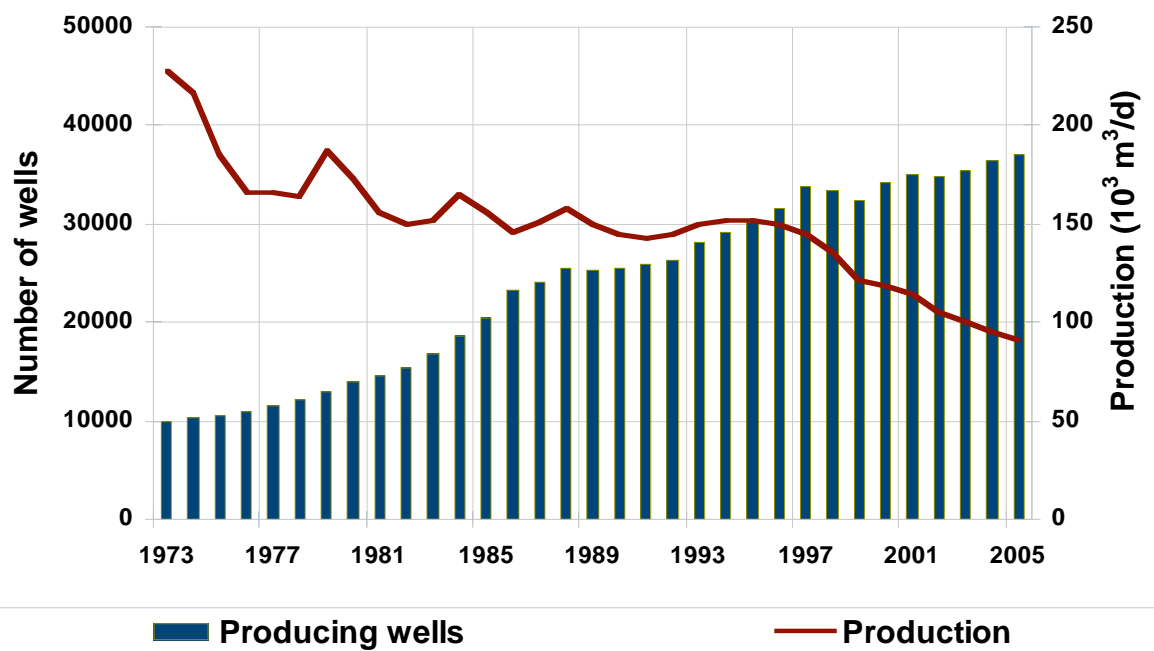
The changing environment

The oil and gas sector in Alberta is undergoing a significant transformation. It is moving away from a reliance on conventional oil to an industry based on non-conventional oil from Alberta's oil sands. Non-conventional gas is also becoming an increasingly important resource. While conventional oil was an important driver of the provincial economy in the past, and will continue to be an economic driver for some time to come, non-conventional oil will be vital to the future growth and prosperity of Alberta.

The pace of development in the oil sands has been accelerating. Investment in the five year period from 1995 to 1999 averaged \$1.47 billion per year. From 2000 to 2004, investment accelerated to \$5.75 billion per year and, in the two year period from 2005 to 2006, investment averaged \$10.3 billion per year. Forecasts indicate that the current level of investment will continue for at least the next five years.

While oil sands production is ramping up, reserves and production of conventional oil and natural gas have peaked and are now declining. Conventional crude oil and natural gas production declined in 2005 and the trends indicate those declines will continue over the long term. New discoveries have smaller pools with lower production rates as well as steeper decline rates. As shown in Figure 7, although the number of producing wells is increasing, the productivity from these wells does not offset the overall decline in production.

Figure 7: Total Crude Production and Producing Crude Oil Wells



Source: EUB ST98-2006

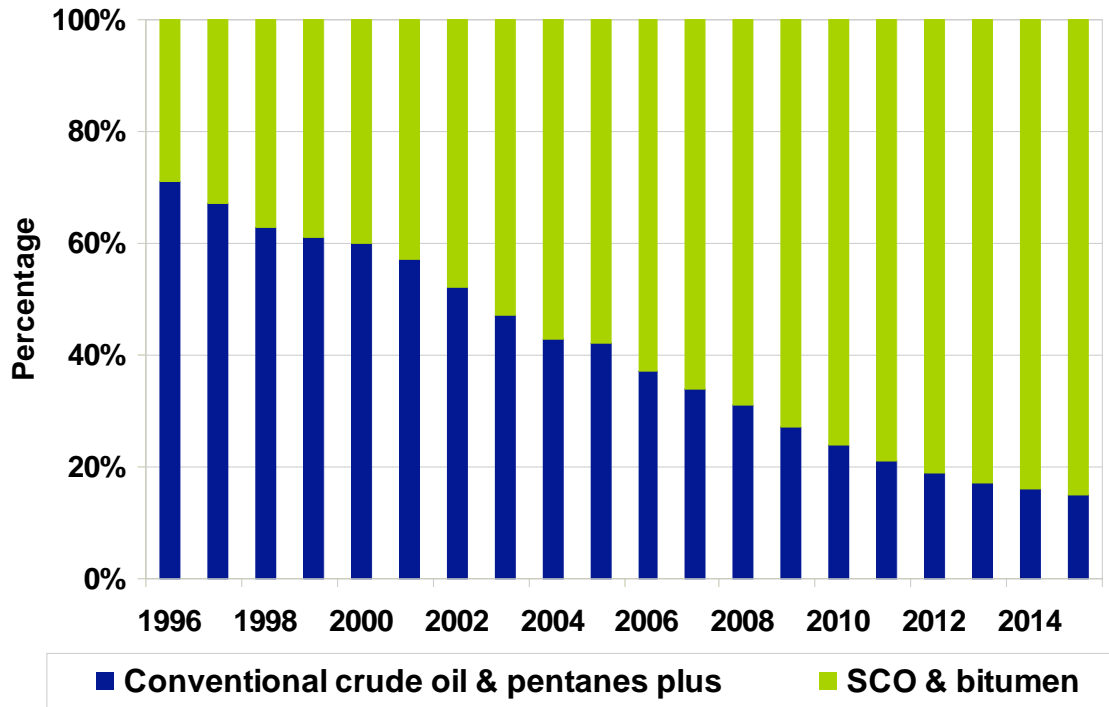
The rate of transition from conventional to non-conventional oil is influenced by the current global energy environment and key factors such as:

- Higher energy prices
- A strong global demand for crude oil
- Concerns over supply
- Greater fiscal capacity of producers (resulting from wider profit margins)
- Technological innovations in oil sands extraction and upgrading which reduce the overall cost per barrel for the production of bitumen and synthetic crude oil

The result is a stronger business case for the development of Alberta's oil sands.

The relative importance of conventional crude oil is diminishing as production of conventional oil declines and non-conventional production continues to increase. The importance of Alberta's non-conventional oil production is clearly evident in Figure 8. In 1996, conventional oil accounted for approximately 70 percent of total production in Alberta and non-conventional represented 30 percent. By 2011, conventional crude will represent only 20 percent of production while synthetic crude oil and bitumen will account for 80 percent of the province's crude oil production.

Figure 8 - Crude Oil Production in Alberta



Source: EUB ST98-2006: Alberta's Energy Reserves 2005 and Supply/Demand Outlook 2006-2015

The outlook to 2011

Underlying assumptions

To prepare a forecast of oil sands growth prospects over the next five years and beyond, a number of assumptions have to be made about key economic factors that impact directly on oil sands production. That includes: the price of oil, the price of natural gas, the value of the Canadian dollar, the differential between the price of bitumen and synthetic crude oil, and the costs of producing bitumen and synthetic crude oil.

The following sections outline our assumptions for each of the key factors. Despite the best available information, it's important to remember that there are substantial risks to any forecast and the risks may be larger today than they were a few years ago.

Oil prices

In 2006 world oil production is expected to be approximately 85.2 million barrels per day (mbd). Canada's crude oil production in 2006 is predicted to be about 2.7 mbd. Canada accounts for about 3.2 percent of global production and, as a result, Canadian output has minimal impact on world oil prices.

Long-term forecasting of world oil prices is fraught with uncertainty. On the demand side, global economic growth rates impact the consumption of oil. In the short to medium term, demand changes slowly based on changes in global economic performance and population changes. However, economic growth in China, and to a lesser degree in India, along with modest increases elsewhere, are expected to result in a long term average growth rate in global demand for crude oil of approximately 1.5 percent per year.

On the supply side, output is expected to grow at a rate that's sufficient to meet world oil requirements. However, crude oil production in a number of countries is maturing, making increases in output more difficult and more costly to achieve. As well, political instability and state ownership and control in some key oil-producing regions of the world will deter investment, resulting in slower growth in output than would otherwise occur. Finally, the potential to disrupt oil production due to weather and geopolitical events is clearly evident and would appear to be a greater risk today than five years ago.

Oil price forecasts from a number of banks, investment dealers, consulting firms, and organizations such as the Conference Board, CERI, NEB and AEUB were examined and showed a wide range of views. The consensus forecast is for oil prices to soften slightly from 2006 levels to around \$55 US per barrel based on West Texas Intermediate (WTI) during the 2006 to 2011 period. Although oil prices are notoriously difficult to forecast, what does seem clear is that the days of oil prices in the \$20 to \$30 range are unlikely to re-occur in the future.

Natural gas prices

Oil sands operations are large consumers of natural gas and that makes the price of natural gas an important factor in the cost of producing bitumen. The natural gas market is largely a North American market. The AEUB indicates that total additions to Alberta natural gas reserves have failed to keep pace with production, which has increased significantly since 1992. The AEUB expects conventional natural gas production to decline during the period 2006 to 2015. Coal bed methane is expected to only partially offset the decline in conventional output. At the same time, demand for Alberta's natural gas is expected to increase, particularly because of its increased use in producing bitumen. During the next decade, natural gas exports to the US are forecast to decline.

Gas price forecasts from a number of industry organizations and government agencies were reviewed. During the next five years, Alberta gas prices are expected to be in the \$7.50 to \$9.00 Cdn. range, averaging around \$8.00 per MMBtu. The Henry Hub price is expected to be in the \$7 to \$8 US per MMBtu range. (The November 2006 Henry Hub price averaged \$7.95 US per MMBtu.)

Canadian dollar exchange rate

After a substantial recovery from a low of \$0.6179 US in January 2002, the Canadian dollar is currently trading at around \$0.88 US. A number of analysts expect the Canadian dollar to continue to trade near current levels over the next five years. However, the value of the Canadian dollar may rise as a result of further weakness in the US dollar as the US begins to deal with substantial budget and trade deficits. We expect the Canadian dollar to be in the low \$0.90 US range between now and 2011.

Bitumen and synthetic crude oil differential

There is no established free and open market for bitumen and no published reference price. Instead, sellers of bitumen relate their prices to prices for other classes of oil in various markets such as WTI, Edmonton light, and Lloydminster blend.

Bitumen prices vary seasonally and over time depending on supply and demand for bitumen, cost of diluent, pipeline capacity, and refinery capacity. Bitumen to light oil price spreads have varied considerably over the past number of years. Data compiled by CAPP indicates that the price of bitumen at Cold Lake averaged 51 percent of the WTI price during the 1997 to 2004 period. The *Economic Impact of Alberta's Oil Sands* study published by CERl in 2005 indicates bitumen to synthetic crude oil yearly average price ratios ranging from 42 percent to 63 percent. Given the increase in bitumen production, price spreads will likely remain relatively wide in the 2006 to 2011 period. Additional upgrader capacity currently under construction or planned should narrow the price spread over the longer term.

Supply costs for bitumen and synthetic crude oil

A June 2006 report from the National Energy Board (*Canada's Oil Sands Opportunities and Challenges to 2015: An Update*) provides some insight into operating costs and supply costs (total costs). Operating costs for Steam Assisted Gravity Drainage (SAGD) are estimated to be in the \$10 to \$14 dollars per barrel range with total supply costs in the \$18 to \$22 range. Operating costs for mining range from \$9 to \$12 and total supply costs run in the \$18 to \$20 range. The NEB study also estimates operating costs for an integrated mining/upgrading operation producing synthetic crude oil to be in the \$18 to \$22 dollars per barrel range at the plant gate. Total plant gate synthetic crude oil supply costs for an integrated mining and upgrading operation were estimated to be in the \$36 to \$40 dollar range.

Total supply costs are particularly sensitive to changes in capital costs, costs of natural gas and production levels. Costs to develop and operate oil sands mines and in situ projects and upgraders have been escalating rapidly as a result of a tight labour market for skilled workers in Alberta combined with high costs for certain materials such as steel. Continued development and commercialization of technology will be critically important to reduce the costs of production.

Risks

A number of risks will have an impact on private sector investment in the oil sands including oil and gas prices, costs, labour and material shortages, and environmental concerns. At the same time, investments in the oil sands are long-term decisions that

are not as readily affected by short-term changes in market conditions and costs as is the case for conventional oil and gas investment.

In the next five years, availability of skilled labour will be a critical challenge for oil sands companies, builders of public and private infrastructure, and those providing goods and services in the three oil sands regions. In the near term, the slowing of other parts of the Canadian economy may ease the challenge of finding skilled employees to work in the Fort McMurray area. However, projects are beginning to ramp up in the Industrial Heartland northeast of Edmonton and these projects will compete directly with Fort McMurray for labour. Although water supply and greenhouse gas emissions may not limit growth in the next five years, these issues clearly need to be addressed in the years ahead.

Growth Forecast 2006 to 2011

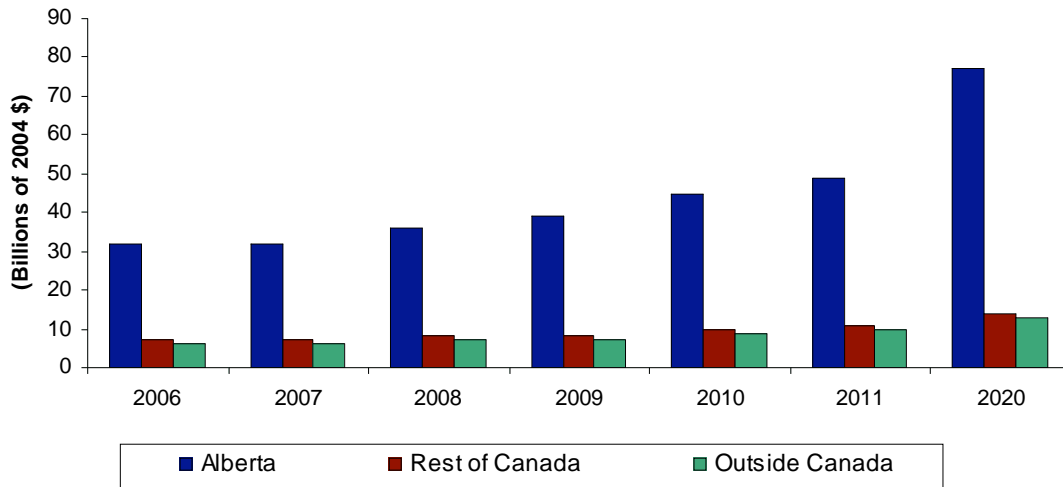
Oil sands contribution to the Alberta and Canadian economy

The oil sands industry contributes to the Alberta, Canadian and global economy through the economic activities associated with the construction of oil sands facilities and from the operation of and production from these facilities. There also are indirect economic impacts from construction of related infrastructure and the provision of goods and services associated with oil sands development and operations.

The 2006 *Economic Impacts of Oil Sands in the Short-Term* study prepared by CERI estimates that the total gross domestic product (GDP) from oil sands activity will grow from \$44 billion in 2006 to \$69 billion by 2011 (all references to CERI numbers are 2004 dollars unless otherwise stated). By 2020, total GDP from oil sands activity is expected to reach \$104 billion. The impacts on Alberta's GDP in 2006 are estimated to be nearly \$32 billion. CERI projects Alberta's GDP from oil sands to reach \$49 billion in 2011 and \$77 billion by 2020.

Impacts for the rest of Canada are projected to reach nearly \$11 billion by 2011 and to exceed \$14 billion by 2020 compared to the 2006 estimate of \$7 billion. The impacts on GDP are heavily influenced by the assumptions about the price of oil and a number of other economic variables. However, we believe the estimates developed by CERI are reasonable and may even be conservative.

Figure 9: GDP Impacts on Alberta, Rest of Canada and Rest of the World



Source: Economic Impacts of Oil Sands in the Short-term, CERl, December 2006

Oil sands activity is expected to become an increasing share of Alberta’s total GDP. In 2006, the total economic impact derived from oil sands and related activity represents approximately 15 percent of Alberta’s total GDP. That is expected to approach 20 percent by 2011.

Clearly, the oil sands represent a significant and growing portion of the Alberta economy.

Capital expenditures

During the six year period 2000 to 2005, capital investment in the oil sands exceeded \$35 billion. The level of investment during the 2006 to 2011 period is expected to climb to \$50 billion. CERl projects that approximately 78 percent of this investment will occur in the Athabasca oil sands region. Nearly 18 percent will occur in the Industrial Heartland region, about three percent will be in Cold Lake, and 1.5 percent of the investment will be in the Peace River region.

Production

Estimates are that about 1.2 million barrels per day (mbd) of bitumen will be produced in 2006. By 2011, production is expected to increase to around 2.0 mbd and to reach 3.8 mbd by 2020. The proportion of bitumen production from each of the three oil sands regions is not expected to change significantly from the current proportions. About 80 percent will come from the Athabasca region, 18 percent from Cold Lake, and two percent from the Peace River region.

In situ production is expected to grow faster than production from mining. By 2011, the portion of bitumen production from in situ methods is expected to represent about 45 percent of total production.

Crude bitumen upgrading in Alberta is projected to be about 1.4 million barrels per day by 2011, compared with the 2006 level of 885,000 barrels per day. Currently, approximately 22 percent of the synthetic crude oil is produced in the Industrial Heartland. By 2011, the portion of bitumen upgraded in the Industrial Heartland area could reach one quarter of the total and be around one third of the total by 2020.

Royalty and tax revenue

The provincial government receives both royalties and tax revenue from developments in the oil sands.

In terms of royalties, oil sands operations have a unique royalty structure. Under the 1997 Oil Sands Royalty Regulation, royalties from oil sands production are based on one percent of gross revenue during the pre-payout of capital period (i.e. during the period until the operator has recovered its capital costs). In the post-payout period, the royalty rate is the greater of one percent of gross revenue or 25 percent of net revenue. Although costs and revenues vary over time, a realistic estimate for oil sands operations is that post payout royalty payments are roughly equivalent to 11 percent of gross revenue.

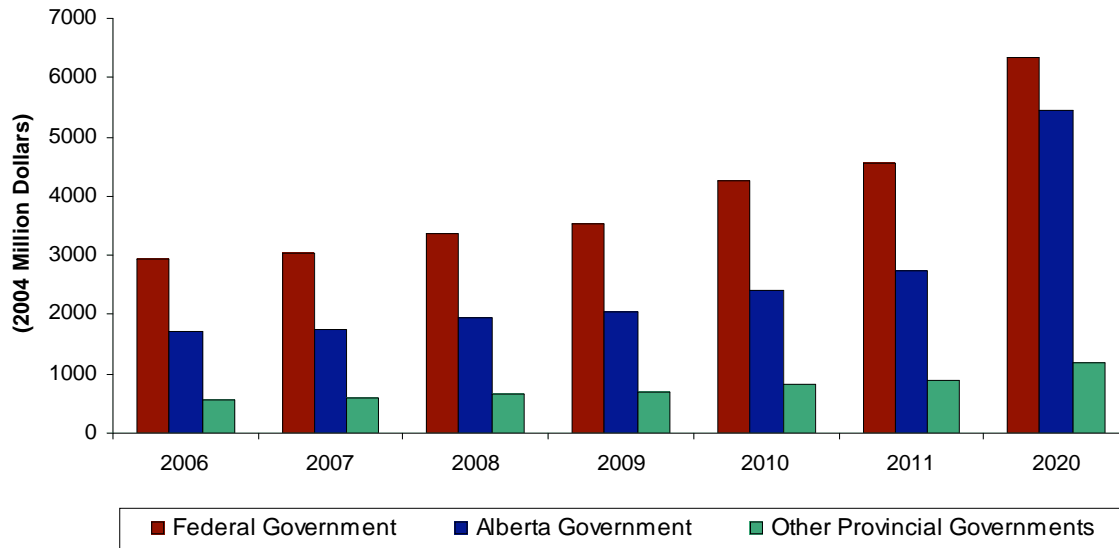
Royalty revenues from oil sands are currently estimated by CERI to be approximately \$861 million dollars and to reach \$1.4 billion by 2011 and \$3.5 billion by 2020. These estimates appear to be low, particularly for the 2006 to 2008 period. During this period, integrated oil sands producers are paying royalties based on their output of synthetic crude oil. After 2008, integrated operators are expected to exercise an option to pay royalties based on bitumen output. This will significantly reduce royalty payments from oil sands operations from 2008 forward.

Tax revenues from oil sands and oil sands related activities come from a combination of corporate income taxes, personal income taxes, indirect corporate and personal taxes, and municipal property taxes. Taxes are paid to the provincial government, to other provinces, to the federal government, to municipalities, and to governments outside of Canada. In addition to royalties, Alberta receives direct corporate and personal income tax. The federal government collects direct corporate and personal income tax as well as indirect taxes.

Annual revenue to the provincial government as a result of both taxes and royalties is expected to be about \$2.7 billion by 2011 and to reach \$5.5 billion by 2020. Federal tax revenues are estimated at \$4.6 billion for 2011 and \$6.3 billion for 2020. Total municipal government revenues for all jurisdictions both inside Alberta and outside of the province are expected to be \$1.2 billion by 2011 and \$1.8 billion in 2020.

Although the federal government does not receive royalties from oil sands developments, they do receive a much greater portion of the total revenues going to all levels of government from oil sands activity than does Alberta. Alberta's portion of total revenue from oil sands and oil sands-related activity is estimated at 25 percent while the federal government's share is 42 percent. Personal and corporate taxes and indirect tax revenues exceed royalty revenues by a considerable amount.

Figure 10: Government Revenues by Jurisdiction



Source: Economic Impacts of Oil Sands in the Short-term, CERI, December 2006

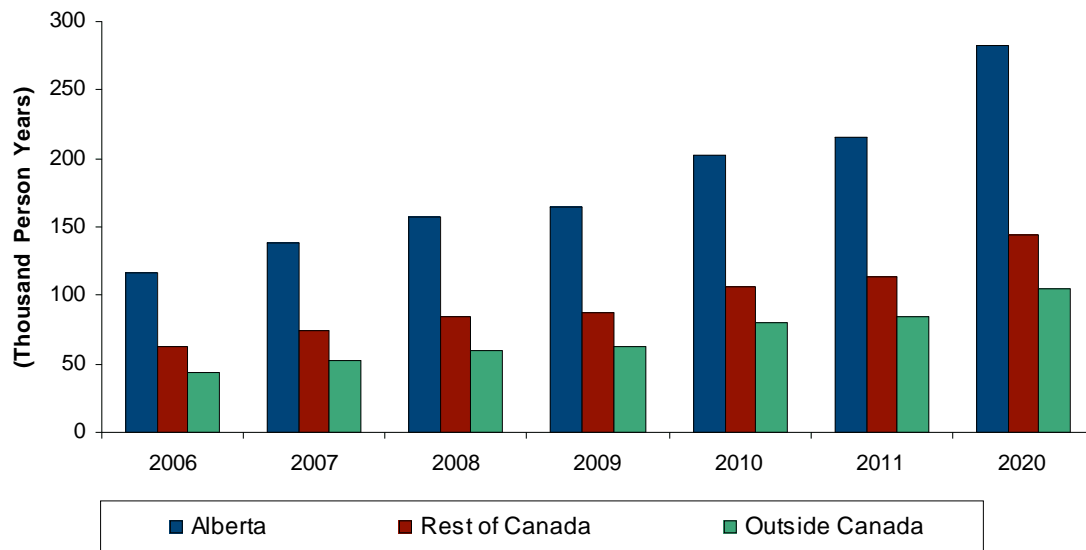
Employment impacts

Skilled labour in Alberta is in short supply. Alberta's unemployment level is running at about 3.5 percent – a level that economists consider to be full employment.

The level of economic activity in Alberta, particularly in conventional oil and gas, oil sands and construction, has resulted in a large influx of workers from elsewhere in Canada and from around the world. Alberta's overall net in-migration during 2006 is expected to be around 73,000 people with about 57,000 of those people coming from other parts of Canada. These levels are at an all-time high and may not be sustainable. Moreover, the current activity levels generated by conventional oil and gas and from oil sands are leading to a "crowding out" effect for other sectors of the economy as workers move to higher paying jobs in the petroleum industry.

Estimates of direct, indirect and induced employment in Alberta prepared by CERI as part of this project indicate that increased employment requirements related to oil sands growth will average nearly 20,000 person years per year during the 2006 to 2011 period. During this same period, additional employment generated elsewhere in Canada is estimated to average nearly 10,000 person years per year. This brings the total employment increases in Alberta and the rest of Canada to nearly 30,000 person years per year.

Figure 11: Employment Impacts on Alberta, Rest of Canada and Rest of the World



Source: Economic Impacts of Oil Sands in the Short-term, CERl, December 2006

During the 2006 to 2011 period, the level of employment increases generated by oil sands activity is expected to keep unemployment levels in Alberta low, require continued in-migration to Alberta, and continue to draw workers from other sectors of the economy.

It is important to distinguish employment created as a result of capital investment versus employment resulting from ongoing operation of oil sands projects. Relatively large portions of the labour required to build oil sands facilities tend to come from outside the region. These workers are often housed in camps as the duration of the construction period is limited and the local community cannot house large numbers of workers. Operations staff with long-term employment prospects are much more likely to want to live in the community where the oil sands facility is located.

Regional employment impacts are much more difficult to estimate than provincial impacts as the data is not available on an oil sands region basis. Work undertaken by CERl and Nichols Applied Management provides some insight into expected regional employment levels between now and 2011. In addition to the three oil sands regions, employment levels resulting from upgrader construction and operation in the Industrial Heartland have also been examined.

Growth in employment in the Fort McMurray region is expected to remain aggressive between now and 2011. Employment in the Cold Lake – Bonnyville area and the Peace River area related to oil sands development and heavy oil production is expected to be much more moderate than Fort McMurray, with growth rates similar to the provincial average.

Employment growth in Fort McMurray is heavily linked to oil sands and oil sands-related development, whereas growth in Cold Lake – Bonnyville and Peace River is much more

heavily influenced by growth in cold production of heavy oil, conventional oil and gas, forestry and other industries.

Employment growth linked to activity in the Industrial Heartland is expected to be substantial from 2006 to 2011. CERI estimates direct, indirect and induced employment to increase from 18,000 person years to 54,000 person years by 2011, an average annual increase of about 7,000 per year between 2006 and 2011. While this number represents a significant increase in employment in the Industrial Heartland, it represents a relatively small percentage of the total labour force in Edmonton and the surrounding region.

Current and expected population changes

Fort McMurray

After a period of vigorous population growth from 1970 to 1986, Fort McMurray experienced more than a decade of static to declining population. Municipal census data indicates that, at just under 37,000 residents, the population of Fort McMurray (urban service area) in 1999 was virtually identical to the population in 1986.

That changed dramatically in the late 1990s. Provincial royalty policy changes combined with federal capital cost allowance incentives changed the economics of oil sands development opportunities. This, along with stronger oil prices, resulted in substantial population growth of the urban service area of Fort McMurray from 36,452 to 64,441 during the seven year period from 1999 to 2006.

The 2006 urban service area population estimate represents an increase of 27,989 residents or 77 percent, an average annual increase of 8.5 percent per year. The 2006 population also includes some shadow population living in motels and campgrounds in the Fort McMurray urban service area. During the same seven year period, the number of people living in camps increased significantly and, in the summer of 2006, stood at 10,442.

The Regional Municipality of Wood Buffalo's 2006 population is 79,810 compared to 56,841 in 1999. Some of the small communities within the Regional Municipality of Wood Buffalo have also experienced significant growth in percentage terms during the past seven years. However, given the small population base of these communities, the total increase is not large.

It's clear that the Fort McMurray urban service area has seen a very large population increase in a relatively short period of time. In percentage terms, the population growth rate of Fort McMurray exceeds the growth rate of any other community in Alberta by a wide margin.

Looking ahead to 2011 the Athabasca Regional Issues Working Group (RIWG) forecasts the population of Fort McMurray to grow at a rate of approximately eight percent (based on work done by Nichols Applied Management). The Regional Municipality of Wood Buffalo has developed three growth scenarios of six, nine and 12 percent and expects the most likely growth rate for planning purposes during the next five years to be nine percent.

Over the next five years, oil sands projects will involve mostly expansions and projects that have already had significant upfront capital invested in engineering and the approval process. Despite anticipated strong growth, the reality is that the growth of the permanent population of the urban service area will be constrained to some degree by the lack of housing and services. As well, some projects, such as the Imperial Oil Kearl Lake project, are a considerable distance from Fort McMurray and it is unlikely that people will live in Fort McMurray and commute on a daily basis. Finally, the ramping up of activity in the Industrial Heartland area will make labour more difficult to attract.

Based on this information, our estimate is that population in the Fort McMurray urban service area will grow at a rate of eight percent per year between now and 2011. The shortage of housing and infrastructure may limit growth to less than eight percent growth. An eight percent annual population growth rate would result in an urban service area population of 95,000 by 2011.

Although we have not included a long-term projection, the population of the urban service area and the Regional Municipality of Wood Buffalo is expected to continue to grow well past the 2011 timeframe. However, we expect the pace of growth to begin to slow past the 2011 timeframe. It would be wise to use a target of at least 150,000 for future planning purposes. During the next five years, camp populations are expected to increase and could exceed 15,000 by 2011.

Given the current gaps in certain key areas of infrastructure, combined with the lag time involved in putting infrastructure in place, population projections should be updated on a regular basis. The longer time frames involved provide the opportunity for planners to adjust population projections up or down as needed over the next 10 to 20 years. Finally, infrastructure needs to be sized appropriately to accommodate increasing populations over a relatively long period of time or, in some cases, constructed in phases.

Cold Lake – Bonnyville

Municipal census population data for the Cold Lake – Bonnyville area is much more limited than data for Fort McMurray and a number of other communities in Alberta.

The most recent municipal census for Cold Lake was 2002. Comparing the 2002 municipal census with the Statistics Canada population census for 1996 and 2001 shows that the population of Cold Lake was more or less unchanged at 11,595 during the 1996 to 2002 period.

The Town of Bonnyville's 2005 municipal census places its population at 5,896. The Statistics Canada census for Bonnyville was 5,709 in 2001 compared with 5,100 in 1996. Census figures for the M.D. of Bonnyville are only available from Statistics Canada. For 1996, the population of the M.D. was 8,977 and increased to 9,473 in 2001.

Alberta health care registration data for the 2001 to 2006 period indicates an increase in the regional population (Cold Lake, Bonnyville and the M.D. of Bonnyville) of 3.5 percent over five years. Although this level of growth is clearly impacting the communities, it is similar to that of many other communities in Alberta. Increased housing starts, house prices, and apartment rental rates, and significant declines in vacancy rates, are further evidence of economic growth in the region.

Nichols Applied Management's forecast of population growth in the Cold Lake – Bonnyville area for 2006 to 2011 is 1.8 percent per year. We concur with this estimate.

Peace River

The Town of Peace River and Northern Sunrise County do not undertake a municipal census. Statistics Canada reports the population of the Town of Peace River at 6,536 for 1996 and 6,240 for 2001, a decline of 4.5 percent. Statistics Canada's census population for Northern Sunrise County was 2,264 for 1996 and 2,123 for 2001, a drop of 6.2 percent. The combined total health care registration numbers for the Town of Peace River and Northern Sunrise County are virtually unchanged for the period 2001 to 2006. However, economic activity in Peace River and surrounding area has certainly increased in the past two years as a result of cold heavy oil production and other industrial activity in the area.

Work undertaken by Nichols Applied Management indicates a modest growth rate of one percent per year during the 2006 to 2011 period for the Peace River Region (excluding the Grande Prairie region). Again, we concur with this growth estimate. However, we recognize that factors other than growth of oil sands and cold heavy oil production, such as conventional oil and gas, forestry, agriculture and eventual construction of the Mackenzie Valley pipeline, could significantly alter the long-term prospects of the Peace River region.

Population growth rates for both the Cold-Lake – Bonnyville region and the Peace River region need to be monitored closely over the next few years. This will require the close cooperation of industry, municipalities and the provincial government. If the rate of growth begins to exceed the forecasts in this report, it will signal the need for more aggressive planning for these two regions than what is currently being undertaken.

<h3>In summary</h3>

The future of Alberta's economy will be heavily tied to energy production and development for many years to come. However, the future looks very different from the past two decades.

The days of cheap oil appear to be a thing of the past. World energy consumption will continue to grow over the next two decades. Although various sources of renewable energy are being developed and production of renewable energy is expected to grow at a faster rate than energy from fossil fuel sources, it is not likely that renewable energy sources could or will meet the growth in energy requirements. Thus, the world will continue to rely on fossil fuel sources during the next two decades.

Oil sands development is occurring at a time when Alberta's conventional oil production continues to decline. As well, Alberta's conventional production of natural gas will be steady to lower in the next two decades. Oil sands development and production will continue to be a major engine of growth in Alberta. Oil sands will represent an increasing portion of Alberta's oil production, overall economic activity, and a substantial source of government taxation (corporate and personal) and royalty revenues.

Oil prices over the next two or three decades will, no doubt, vary considerably; however, they are expected to be sufficiently high to continue to attract oil sands investment and development.

Decisions regarding oil sands development are very long-term decisions with time horizons of 20 to 50 years. They also involve a significant amount of risk and uncertainty related to the price of bitumen and synthetic crude oil and the cost of constructing and operating oil sands facilities. There also are a number of risks regarding environmental factors such as the levels of greenhouse gas emissions, water availability, and costs of reclamation. As well, any changes in federal and provincial policy regarding tax and royalty regimes will have an impact on investment decisions.

Despite higher oil prices, it is reasonably clear that not all projects that have been announced will be built during the next 10 to 15 years. Development during the period 2006 to 2011 is considerably more certain, as it represents primarily expansion of existing operations and new developments that are underway or have already had significant investments to date. Although there are a number of constraints, availability of labour will be the most critical constraint in the development of oil sands operations and of needed infrastructure over the next five years. In the medium and longer term, factors such as water availability and emission levels could limit oil sands growth.

The bottom line is that oil sands development is expected to continue at a brisk pace between now and 2020.

Where are the gaps?

A critical objective of this study is to identify where there are current and projected gaps in infrastructure and in core services in each of the three oil sands areas. This information is essential for planning purposes and to identify key priorities and next steps to be taken.

Our analysis of gaps focuses on the following areas:

- Housing
- Transportation
- Basic municipal infrastructure – water treatment, waste water treatment and landfill
- Health care
- Education
- Social services
- Policing
- Environment

A common theme that cuts across all these specific areas is the challenge of recruiting and retaining the necessary staff to deliver key services. Increased affordable housing and specific steps to address the workforce issue are key to resolving a number of the gaps outlined in this chapter.

Although workforce shortages exist throughout Alberta, they are much more severe in the Regional Municipality of Wood Buffalo, where there is a high demand for skilled labour such as trades, technical workers, teachers, physicians, and other health care workers and a high demand for unskilled labour mainly involved in the service sector.

The lack of affordable housing in Fort McMurray, the relatively isolated location, and the high cost of living all tend to limit the number of families that consider moving to the community and thereby contributing to the workforce. Over 75 percent of new jobs created in Alberta in 2002-05 required a post secondary credential. Future projections indicate that 64 percent of new jobs will require post secondary credentials.

An estimated 62 percent of Fort McMurray's population are employed by an oil company or contractor. The large demand and high wages in the oil sands industry increase competition for available labour to work for the municipality, the provincial government and its agencies, and for businesses outside of the oil sands sector.

Employers in Fort McMurray experience high turnover rates. The high turnover means existing staff spend time on mentoring and recruitment, rather than other aspects of their job. It also results in a relatively new workforce with less expertise and less productivity.

The government of Alberta is implementing its new labour force development strategy, *Building and Educating Tomorrow's Workforce*. It focuses on increasing labour supply and developing innovative work environments through increased use of technology. There are a number of sub-strategies to address industry-specific issues. A regional recruitment team has also been established to address the difficulties in recruiting public service workers to Fort McMurray. A multi-department initiative is underway to identify workforce needs and develop appropriate labour supply strategies to address shortages.

In addition, a number of initiatives currently underway will help address workforce challenges including:

- building more affordable housing
- providing cost of living allowances and other incentives
- increasing recreational opportunities for families
- expanding provincial programs such as the Provincial Nominee Program (fast tracking immigration for specialized labour)
- maximizing use of federal programs (recruitment from outside Alberta and Canada)
- providing immigration programs to assist new families in integrating into the community (e.g. English as a second language etc)
- expanding programs to increase the skills of people who are underutilized in the labour force (e.g. Aboriginal people)
- expanding support to assist people with disabilities to overcome barriers to employment
- using mentoring programs
- increasing apprenticeships to provide training
- providing adult literacy programs

Housing

The availability of housing to meet current and anticipated demands in each of the three oil sands areas is a critical issue, especially in the Regional Municipality of Wood Buffalo.

To assess the current and projected gaps in housing, a number of indicators were reviewed. The indicators listed below provide a comprehensive assessment of the housing situation and future prospects for housing developments to meet expected levels of community population growth.

- House prices and affordability
- Rental rates
- Vacancy rates for rental properties
- Housing starts
- Number of residents per household
- Housing allowances
- Supply of affordable housing to meet needs
- Availability of developable land for housing
- Cost of developing land for housing
- Ability to construct housing at a pace commensurate with expected growth

Considerable information is available about the supply and affordability of housing in the Fort McMurray urban service area. But information about smaller communities in the Regional Municipality of Wood Buffalo, Cold Lake – Bonnyville region and the Peace River region is much more limited.

Current Situation

Fort McMurray and the Regional Municipality of Wood Buffalo

Housing supply

Fort McMurray has grown at a rapid pace, far outstripping the rate of growth in any other community in Alberta. Moreover, the percentage rate of population growth from 2006 to 2011 is expected to continue to be much greater than that of any other community in Alberta.

The pace of growth has severely taxed the ability of the municipality to undertake comprehensive planning for development. Plans developed a number of years ago don't apply to today's situation and are of little use. As well, there are limitations on the ability of private sector developers and home builders to increase the supply of housing at a rate that meets the pace of demands.

During the high growth period of the past seven years, the supply of housing in Fort McMurray has not kept pace with the demand. As a result, Fort McMurray has experienced rapidly escalating house prices and rental rates and a vacancy rate approaching zero. The 2006 housing deficit in Fort McMurray was recently estimated by Gary Gordon and Associates at 3,900 housing units. This estimate appears to assume that if there were adequate housing there would be no camp population. We do not believe this assumption is realistic. While camp numbers would likely decline if there was more housing available, we believe many companies would continue to utilize work camps, particularly for the construction phase of their projects.

The estimate of housing requirements also does not appear to take into account the fact that the number of residents per dwelling in Fort McMurray is well above that of other communities. If adequate housing were available, the ratio of persons per household would be lower. Although we partially disagree with the methodology used to determine the housing unit shortage, we believe a housing shortage estimate in the 3,500 to 4,000 range is realistic.

House prices

In 2005, Fort McMurray had the highest house prices in Alberta. According to Alberta Economic Development's 2005 *Place-to-Place Price Comparison Survey*, shelter costs in Fort McMurray were 70 percent above those of Edmonton. Information from the Fort McMurray Real Estate Board indicates the average single-family home price was \$483,913 in September 2006 compared with a price of \$326,292 in Edmonton. (Source: Edmonton Real Estate Board, October 2006) The Calgary Real Estate Board indicates the average price of a single family home in Calgary in September 2006 was \$410,326.

Rental rates

The Community Services Department of the Regional Municipality of Wood Buffalo undertakes regular rental market surveys. Data from the June 2006 survey indicates that a one bedroom apartment in the Fort McMurray urban service area rented for \$1,226 and a two bedroom apartment rented for \$1,387 per month. By October 2006, those rates had climbed to \$1,314 per month for a one bedroom apartment and \$1,536 for a

two bedroom apartment. (Source: Fort McMurray Landlord and Tenants Advisory Board) These rates are considerably higher than the 2000 rates of \$760 for a one bedroom and \$895 for a two bedroom apartment.

Vacancy rates

Information from the Fort McMurray Landlord and Tenants Advisory Board indicates the vacancy rate in the Fort McMurray urban area in October 2006 was at or approaching zero. The June 2006 vacancy rate for apartments was 0.37 percent. Economists consider a vacancy rate of three percent to be a reasonably balanced rental market in that supply and demand are balanced.

Housing starts for the Regional Municipality of Wood Buffalo

From 2001 to 2005, housing starts averaged 1,087 per year. Since then, the pace of construction has increased significantly, with housing starts to the end of October 2006 at 1,668 dwelling units.

From 2001 to 2004, the number of dwelling units increased from 16,244 to 19,782, an increase of 3,538 or 21.8 percent. This represents a compound growth rate in housing stock of 6.8 percent per year and is well short of the population growth rate. (Source – Municipal Affairs community profile for Regional Municipality of Wood Buffalo)

Table 3: Housing Starts for Regional Municipality of Wood Buffalo

Year	2001	2002	2003	2004	2005	2006 estimate
Number of Housing Starts	1,063	1,018	681	1,130	1,551	1,800+

Source: Alberta Municipal Affairs

Number of residents per household

A vacancy rate at or approaching zero combined with high rental rates and house prices have produced a pent-up demand for housing in Fort McMurray. Not surprisingly, occupancy rates in Fort McMurray are higher per household than in other cities of a similar size. The Regional Municipality of Wood Buffalo census indicates an average of 3.3 persons per single family dwelling and 2.5 persons per apartment in Fort McMurray versus 2.86 persons per single family dwelling and 1.5 persons per apartment in Red Deer. (Sources: Housing Overview and Outlook, October 5, 2006 Gary Gordon and Associates; 2005 municipal census)

As well, the municipal census likely does not include some people who are renting illegal suites and rooms in private homes and situations where a number of people share accommodation.

Housing and living out allowances

Oil sands companies and their contractors operating in the Fort McMurray area make widespread use of camp accommodations. Contractors working on oil sands projects pay living out allowances to construction workers when camp space is not available. A typical rate for the living out allowance is \$130 per day with most capped at a maximum

monthly amount of \$3,000. Currently, a fair number of living out allowances are in the range of \$1,800 to \$2,000 per month. Living out allowances used by oil sands contractors are inflationary and have contributed to the high cost of rent and home prices in Fort McMurray.

Partly as a result of the high cost of rent and housing, it is increasingly difficult to attract and retain key public sector workers such as nurses, teachers, RCMP, and municipal and provincial government staff. A number of public sector employers have begun to offer housing allowances, but these allowances are extremely modest when compared with the living out allowance paid by oil sands contractors. To address this issue, effective April 1, 2006, the provincial government began providing an allowance of \$1,040 per month to employees who work and live in Fort McMurray. (Contrary to what we heard from some representatives of public agencies in Fort McMurray, provincial employees living and working in the Fort McMurray area do not also receive an additional week of holidays and two paid trips. These benefits apply only to provincial employees working north of the 57th parallel.)

Effective July 1, 2006, the Alberta government implemented an attraction and retention bonus for people newly hired or existing employees not currently living in Fort McMurray or north of the 57th parallel. The bonus amounts to 25 percent of base pay and is paid quarterly over the first year of employment. Employees must agree to work at least two years in Fort McMurray or else they are required to repay the bonus on a pro-rated basis.

Unfortunately, the province did not address employee attraction and retention on a comprehensive basis for all public service workers who rely directly on provincial funding. No funding was provided for school boards or the Northern Lights Regional Health Authority to provide similar programs. These organizations provide housing allowances, but at lower levels than the provincial government and the funding must come from within their existing budgets. Greater coordination across all public sector agencies is needed.

Table 4: A Comparison of Cost of Living Allowances in the Public Sector

Organization	Allowance
Regional Municipality of Wood Buffalo	\$433 per month (\$200 per bi-weekly pay period) plus a \$350 per month wellness allowance.
Keyano College	\$525 per month
Separate School District Teachers	\$475 per month (\$5,700 per year)
Public School District Teachers	\$292 per month (\$3,500 per year) plus a modest grid adjustment.
Northern Lights Health Region	\$300 per month
Provincial Government Employees	\$1040 per month

Source: Personal communication with the respective agencies.

Affordable housing

The Regional Municipality of Wood Buffalo formed the Wood Buffalo Housing and Development Corporation (WBHDC) to address and manage the need for affordable housing in the municipality. The WBHDC operates as a not-for-profit company and

provides a number of housing programs funded in several different ways, including both rental and ownership options. As of July 2006, WBHDC managed approximately 700 affordable housing units. During the July to December 2006 period, an additional 103 units were developed. By May 2007, WBHDC expects to add a further 90 units, bringing the total to approximately 900 affordable housing units.

Since 2002, approximately \$17 million in funding has been approved for 414 affordable housing units in Fort McMurray through the Canada-Alberta Affordable Housing Program. (Source: Alberta Seniors and Community Supports) In October 2006, the number of rent supplement units was increased by 75.

WBHDC has a number of units under development or planned during the next three years. Land for 300 affordable housing units in each of parcels D and F was set aside. WBHDC expects the units in parcel D to be completed in 2008 and in parcel F to be completed in 2009. (See Appendix 4 for a map showing the location of these parcels) WBHDC is also examining the need to provide some affordable housing units in Anzac and Conklin.

In addition, WBHDC is looking into the possibility of redeveloping land in the downtown area. They are working on a plan to redevelop a parcel of land called Willow Square which is currently owned by CMHC. WBHDC advises that this land could accommodate up to 520 affordable housing units; however, sewer capacity will be a challenge and could limit development. In any event, this housing would not come on stream before 2008. At some point in the future, it may be possible to develop the Clearwater school site for affordable housing but this is a number of years away, if it occurs at all.

WBHDC has formed a unique partnership with a number of public sector employers including the RCMP, the public and separate school boards, the Northern Lights Regional Health Authority, and the Regional Municipality of Wood Buffalo. Each of these employers has partially funded 18 affordable housing units for a total of 90 units. These units will be available to house new employees of the various public sector groups for up to one year. After one year, the employees are expected to find alternate accommodation.

As of November 5, 2006 the waiting list for affordable housing in Fort McMurray was for 429 units. The number of households on the waiting list has increased significantly during the past year from under 200 in 2005 to averaging over 400 during 2006. (Source: WBHDC)

Availability of land

A number of studies and planning initiatives are currently underway in the Fort McMurray urban service area. However, it is fair to say that comprehensive planning needs to be undertaken to address the availability of land to meet future housing needs and to set priorities for which lands should be developed first.

An Area Structure Plan is currently in the works for the Saline Creek Plateau area but this work has not progressed at the pace that's needed primarily because of a shortage of resources to meet planning requirements. As well, a few outstanding issues need to be resolved including alternate access and a lease held by the Rotary Club from Alberta Sustainable Resource Development on approximately 400 acres in the Saline Creek

area. The issue with the Rotary lease is whether this land will be developed for a golf course or for housing.

A Fringe Area study is also being undertaken to determine the feasibility of future development in several major areas, including: two areas in the Southwest between the Horse and the Hangingstone Rivers and north of the Hangingstone River; an area called Forest Heights which is east of the Clearwater River; land north of Parsons Creek, Saline Creek Plateau and the Northwest Growth Area. The study will help set land development priorities by evaluating the potential for and costs of developing housing in these areas.

There also are some opportunities to increase density in the downtown area. Before in-fill could occur in a significant way, a major planning exercise is required to evaluate land use requirements for residential and commercial purposes, traffic, roadways and utilities such as water and sewer capacity, and a number of other matters. However, the opportunities to accommodate substantial increases in density are currently limited by water and sewer infrastructure capacity.

Costs to develop land

Costs to develop land in the Fort McMurray urban service area are extremely high. The topography, the fact that access to some areas requires expensive bridges or major interchanges with highway 63, the distance to bring utilities, and the past under-sizing of utilities to meet current populations all contribute to development costs. In addition, construction costs in Fort McMurray run well above those of Edmonton.

Housing requirements and ability to construct housing to meet needs

As indicated earlier in this report, the population of the Fort McMurray urban service area is expected to reach 95,000 by the end of 2011. This is an increase of approximately 30,000 residents over the next five years. Based on an average of three people per housing unit, an additional 10,000 units would be required to accommodate the population increase. Together with the current backlog of around 4,000 units, the total increase in housing stock requirements between now and the end of 2011 would be 14,000 units.

Cold Lake – Bonnyville

The Cold Lake – Bonnyville region has not grown at anywhere near the pace of Fort McMurray. Recent house price trends, increasing rental rates, very low to non-existent vacancy rates, and the increase in housing starts indicate that the population of the region is growing at a faster pace than in prior years and at a rate that's similar to a number of other communities across Alberta.

House prices and affordability

House prices in Cold Lake – Bonnyville have escalated during the past two years and especially during the past year. The average price for a single family home in the Cold Lake – Bonnyville area was \$212,000 in October 2006.

Rental rates

December 2005 rental rates in the City of Cold Lake were \$646 for a one bedroom apartment, \$740 for a two bedroom, and \$857 for a three bedroom. Apartment rental rates in Cold Lake increased by 13.1 percent between January and July 2006. (Source: City of Cold Lake Economic Development Advisory Committee Opportunity Identification Group's 2006 report on Affordable Housing)

The affordable housing report also indicates that one out of seven households in Cold Lake has temporary boarders who cannot find affordable housing. At the same time, a number of households that do not currently have boarders are interested and willing to provide housing.

Vacancy rates for rental properties

In mid-2006, Cold Lake had 495 apartments. The vacancy rate in July 2006 was estimated to be 0.004 percent, considerably lower than the September 2005 vacancy rate of 0.6 percent and the December 2005 rate of 1.2 percent. These vacancy rates are well below the Central Housing and Mortgage Corporation's (CMHC) survey results for Cold Lake for 2004 and 2005 which show an apartment vacancy rate of 10.6 percent in 2004 and a 5.8 vacancy rate in 2005.

Table 5: Housing Starts in the City of Cold Lake, Town of Bonnyville and M.D. of Bonnyville

Year	2001	2002	2003	2004	2005	2006 estimate
Cold Lake Housing Starts	117	110	94	151	133	191
Town of Bonnyville Housing Starts	11	30	32	27	41	54
M.D. of Bonnyville Housing Starts	104	128	126	116	162	184

Source: Alberta Municipal Affairs

Number of residents per household

2001 Statistics Canada census data indicated that there was an average of 2.88 persons per dwelling unit in Cold Lake. The Town of Bonnyville had 2.74 persons per dwelling and the M.D. of Bonnyville reported 2.97 persons per dwelling.

Housing allowances

The provincial government does not pay any special housing allowances in the Cold Lake – Bonnyville region, nor does it pay attraction or retention bonuses. To our knowledge, other public sector service agencies do not pay housing allowances in the region.

Supply of affordable housing to meet needs

The Cold Lake Housing Society has a mandate to assist and/or spearhead projects aimed at addressing affordable housing gaps in the community. The 2006 affordable housing report for Cold Lake identified gaps in affordable housing in a number of areas.

Subsidized housing in Cold Lake is provided by the Lakeland Housing Authority and Métis Urban Housing. These two organizations manage approximately 76 units. The Lakeland Housing Authority indicated at the time the community's *Report on Affordable Housing* was prepared that "there is always ten or so individuals or families on their waiting list for non-senior subsidized housing." Métis Urban Housing reports that there are normally 45 or more families on their waiting list which means a wait of five to six years.

In Bonnyville, affordable housing projects are driven by community-based groups. The Bonnyville Affordable Housing Association was formed to address the challenge of providing affordable housing.

Availability of developable land for housing

Cold Lake has an adequate supply of land for housing. Bonnyville is currently short of lots, but there is land available that can be developed for housing. As well, housing is being developed in the M.D. of Bonnyville. The City of Cold Lake is concerned about the cost of offsite levies and their impact on city budgets and house prices. Construction costs are escalating in the Cold Lake – Bonnyville area as they are elsewhere in the province. Cold Lake construction costs appear to be higher than in Edmonton, but not as high as they are in Fort McMurray.

Peace River

The Town of Peace River's population growth has been highly variable over the last few decades and, as a result, the housing situation has changed considerably. Substantial growth occurred between 1961 and 1991 but that was followed by a decade with a slight decline in population.

Peace River's population stood at 6,240 in 2001 (Statistics Canada). Unfortunately, no municipal census has been undertaken to assess population and housing requirements since 2001. However, economic activity and the changing housing market suggest growth has occurred during the past two years. Increases in economic activity in cold heavy oil production east of Peace River, along with other economic activity, have strengthened the local economy and the demand for housing. Northern Sunrise County, where heavy oil production is taking place, saw a slight increase in population during the 1996 to 2001 period. Again, there are no official population census numbers for the County since 2001.

Recent house price trends, rental rates, very low vacancy rates, and the increase in housing starts indicate that the population of the region is growing at a faster pace. The region and the corresponding demand for housing are growing at about the same rate as a number of other communities across Alberta. Nonetheless, there is a need to bring on more housing units to balance the market. This process appears to be underway.

House prices and affordability

House prices in Peace River have escalated considerably during the past two years, particularly during the past year. Information provided by a Peace River realtor indicates

that a typical 1,100 to 1,200 square foot home in the Town of Peace River was selling in the \$250,000 to \$260,000 range in the fall of 2006.

Rental rates

Alberta Seniors and Community Supports conducts an annual survey of apartment vacancy and rental rates in 63 communities. The 2006 survey, conducted during June, July and August, shows that average apartment rental rates in the Town of Peace River for one, two and three bedroom units were \$560, \$629, and \$726 respectively.

Vacancy rates for rental properties

The Alberta Seniors and Community Supports apartment survey found that the overall apartment vacancy rate in the summer of 2006 was 0.7 percent. This vacancy rate is well below the 2005 vacancy rate of 3.7 percent and the 2004 rate of 5.4 percent. From 1997 to 2000 apartment vacancy rates in Peace River were greater than nine percent.

Housing starts

The town of Peace River’s housing starts in 2005 include 19 single family dwellings plus a 32 unit condo complex. For 2006, housing starts include 25 single family dwellings, three semi-detached dwellings, a 71 suite apartment, and seven additional apartment units in two separate developments.

Table 6: Town of Peace River and Northern Sunrise County Housing Starts

Year	2001	2002	2003	2004	2005	2006 Estimate
Peace River Housing Starts	6	12	10	18	51	109 to November 17 th
Northern Sunrise Housing Starts	3	4	7	11	10	27

Source: Alberta Municipal Affairs

Number of residents per household

The 2001 census data indicates that there were 2.63 persons per household in the Town of Peace River.

Housing allowances

The provincial government does not pay any special housing allowances for staff living and working in the Town of Peace River or the surrounding area. To our knowledge, other public sector agencies also do not pay housing allowances.

Supply of affordable housing to meet needs

The North Peace Housing Foundation provides affordable housing in the Peace River area. The Foundation manages 81 units in the Town of Peace River and 36 in Grimshaw. The waiting list for affordable housing is typically about 12 families.

Availability of developable land for housing

According to the *Town of Peace River Growth Study* (Brown and Associates Planning Group, April 2006), the town has an inventory of 759 acres of vacant developable land within the existing town boundaries to accommodate future growth. That includes 698 acres of vacant residential land and 60 acres of vacant commercial land. Recently, the town of Peace River approved a new sub-division. Phase I of this sub-division has 31 lots which have been serviced and three more phases are planned. This indicates that Peace River has sufficient land to accommodate new housing and that the land is being brought on stream as needed.

Cost of developing land for housing

According to the Brown and Associates study, the topography and soil conditions in the Town of Peace River result in higher infrastructure costs for urban development than those of many other communities.

Looking ahead

Fort McMurray

The following table summarizes land being developed or potentially available for development during the 2007 to 2011 period. The table also provides estimates of the number of housing units each parcel contains or may contain, the number of people that can be housed, and the number of affordable housing units set aside or likely to be requested.

Table 7: Land Available for Housing in the Fort McMurray Urban Service Area – Current and Future Development

Land Base	Number of Housing Units	Number of Residents housed	Number of Affordable Housing Units	Timing of Development
Consortium Lands, Devonian Lands, Other	1500	4400		Land previously sold by Alberta Seniors and Community Supports. Development currently ongoing.
Bond Towers – lower Townsite in-fill	600	1,200		Development permits for Bond Towers have been issued by RMWB. Development has not yet started.
Long Boat Landing – lower Townsite	1100	2,900		Construction has begun on Phase I. Timing is 2006 – 09.
Parcel D	3700	10,700	300 affordable units	Timberlea subdivision. Development currently underway by Centron. Completion expected by December 2007.
Parcel F	1700	3400	300 affordable units	Timberlea subdivision. Planning and engineering currently underway by Sureway and Beaverbrook. Servicing expected in 2007. Completion expected by December 2008.
Saline Creek	7,400	20,000	WBHDC intends to request affordable housing units Likely about 600 units	Area structure plan not yet complete. Likely 2009 or 2010 before housing units would be under construction. There are a number of unknowns until the area structure plan is completed and approved.
North Parsons Creek	3,000	8000	300	Parsons Creek is likely to be developed after Saline Creek.
Willow Square Redevelopment	-	1000	390	Willow Square is currently owned by CMHC and is being considered for redevelopment as affordable housing.
TOTAL	19,000	51,600	1,890	

Sources: Land Release Strategy, Alberta Municipal Affairs; Alberta Seniors and Community Supports; Housing Strategy for the Future, Wood Buffalo Housing and Development Corporation; Draft Area Development and Growth Constraints Assessment for the Fringe Area, Armin A. Preitksaitis and Associates Ltd.; Housing Overview and Outlook, Gary L. Gordon and Associates

It should be noted that the number of housing units included in Table 7 will vary considerably depending on final decisions regarding housing density. As well, the draft Fringe Area study indicates that a number of other parcels not included in Table 7 such as the land between the Horse and the Hangingstone Rivers provides substantial capacity for additional housing.

Given the levels of oil sands investment expected to be undertaken in the Regional Municipality of Wood Buffalo, the growth rate of the Fort McMurray area is expected to be such that the availability and the cost of housing and rental accommodation cannot be addressed on a “quick fix” basis. It will take a number of years to build an adequate supply of housing to meet current and projected needs.

To clear the housing backlog and meet demand over the next five years, 2,800 housing units will need to be built each year. This is highly unlikely in the current environment. However, it does underline the need for the Regional Municipality of Wood Buffalo to move quickly to complete a number of planning processes. The provincial government also has a role to play in assisting with planning if required and ensuring the timely sale of public land as soon as area structure plans and other requirements are met.

Constraints with regard to the availability of skilled labour, the amount of serviced land, cost to service raw land, and delays in completion of planning documents, such as the area structure plan for the Saline Creek area, mean that the Fort McMurray construction industry will have a difficult time delivering higher levels of home construction than in 2006. However, the number of housing starts is also influenced by the type of housing being developed and could increase if the portion of multi-family dwellings were increased.

The Saline Creek area is the next logical major parcel of land to be developed for housing. Given the costs associated with residential land development in Fort McMurray, it seems reasonable to expect the Rotary lease lands in the Saline Creek area to be developed for housing. However, the municipality needs to work closely with the Rotary Club to address the matter of alternate land to meet their park and golf course needs. Alberta Sustainable Resource Development has identified alternative parcels of land that could be made available to the Rotary Club.

The *Draft Area Development and Growth Constraints Assessment for the Fringe Area* report (November 10, 2006) clearly indicates that there is sufficient land available for development in the Fort McMurray urban service area.

Cold Lake – Bonnyville and Peace River Regions

Although the Cold Lake – Bonnyville and Peace River regions are both facing housing shortages and near zero apartment vacancy rates, our view is that this can be addressed through normal market channels and ongoing affordable housing programs. Population growth projections and the implications for housing requirements in these two communities should be monitored closely through cooperation of the respective municipal governments, the province and the oil sands industry.

Observations

Based on our assessment of the information available on housing in the three oil sands areas, a number of observations can be made.

There is sufficient land available for housing in the Fort McMurray urban service area to meet the needs through 2011 and for the foreseeable future. The adequacy of the supply of land available for housing depends heavily on decisions regarding density and land use. We understand that the Regional Municipality of Wood Buffalo intends to increase the residential density of future development but this will require upgrades to utility infrastructure particularly in the lower town site. Some of the land potentially available for housing will be relatively expensive to develop.

The severe housing shortage in Fort McMurray needs to be addressed on an urgent basis.

Although land is available for affordable housing in Parcels D and F, no provincial funding has yet been committed for developing affordable housing in these parcels. The federal-provincial Affordable Housing Partnerships Initiative is an important initiative to provide affordable housing in communities across Alberta. The program is intended to address needs across the province but it does not have the capacity to meet the substantial affordable housing needs of Fort McMurray. Furthermore, it is unlikely that the federal government will commit further funding during the next three years.

To address affordable housing in Fort McMurray, an investment of \$150,000 per unit is required. That puts the funding gap for parcels D and F alone at \$90 million. These funds are needed to address the affordable housing gap for the 2007-08 budget year.

In addition to parcels D and F, land available or expected to be requested over the next five years would potentially provide for a further 1,300 affordable housing units. At \$150,000 per unit, the total cost of these additional units is \$195 million.

Transportation

The availability of roads, highways, railways and airports is critical to the future development of Alberta's three oil sands areas. Heavy industrial use takes its toll on existing roads and growing populations, especially in Fort McMurray, mean increasing demands for roads, interchanges and bridges.

Across the province, the provincial government is responsible for the construction, maintenance and rehabilitation of provincial highways. Municipalities are responsible for the construction and maintenance of their local road network; however, the provincial government does provide some grant funding to municipalities for roads under municipal jurisdiction.

The current situation

Regional Municipality of Wood Buffalo

Provincial transportation projects

Highway 63 is the single route into Fort McMurray. It serves as a commuter highway, truck route, dangerous goods route, and the only arterial route through the urban service area. Highway 63 north of Fort McMurray has high traffic volumes and is characterized by high morning and afternoon peaks. Traffic south of Fort McMurray on Highway 63 has significant peaks southbound on Thursday evenings and northbound on Sunday evenings as a result of shift changes at the major industrial projects. Highway 881 links to Highway 63 approximately 25 km south of Fort McMurray and serves the in situ oil sands projects in the southern part of the region. Highway 881 provides a lengthier alternate route to Fort McMurray.

The Government of Alberta has committed to twinning the 240 km section of Highway 63 between Fort McMurray and the junction of Highway 55 near Grassland. The cost is estimated to be over \$940 million and twinning will begin at Fort McMurray and proceed south to Grassland. The federal government, as part of the Canada Strategic Infrastructure Fund, will provide \$150 million for the project.

The status of near-term transportation projects in the region is as follows:

- Grading from Suncor to north of Mildred Lake for the twinning of Highway 63 was completed in 2006; paving will begin in 2007
- Pavement overlays and improvements to climbing and passing lanes were completed from north of House River to south of Mariana Lake (Mariana Lake is about 100 km south of Fort McMurray)
- Widening of 9 km of Highway 881 from Anzac to Highway 63 was tendered; the remaining 19 km requires consultation and agreement with the local First Nations
- Paving the full length of Highway 881 was completed in 2006, ahead of schedule
- Construction for the twinning of Highway 63 is scheduled to begin in 2007; some clearing work was completed in 2006
- Planning and design work is underway for interchanges on Highway 63 in Fort McMurray
- Design is underway for the third bridge, crossing the Athabasca River in the urban service area

Municipal transportation projects

Two major municipal transportation projects have been identified for the urban service area of Fort McMurray (RIWG December 2005 Business Case) – the Clearwater Drive/Keyano College access estimated at \$10 million and the Clearwater Drive/Highway 63 to Morrison Street project estimated at \$50 million. The costs for these projects have increased to \$22 million and \$52 million respectively. The municipality will fund these projects over the next three years with some grant funding provided by the Alberta government.

Total funding commitments by the Regional Municipality of Wood Buffalo for all transportation-related infrastructure projects is approximately \$44 million for 2007, of which \$8.3 million is funded through grants from the provincial government.

Airports

The Fort McMurray Airport is a full-service facility with a modern air terminal and a paved 6,000 ft. runway. The airport services about 42,000 flights annually and accommodates over 200,000 passengers each year. It is served by five air carriers: Air Canada, Air Canada Jazz, West Jet, Corporate Express, and Air Mikisew and serves as a base for the charter company McMurray Aviation. These carriers offer scheduled service to Edmonton, Calgary, Vancouver, Yellowknife, Toronto, Fort Smith and Fort Chipewyan. The airport has received assistance from the federal Airport Capital Assistance Program to upgrade the ramp area and associated infrastructure. The airport is also self-financing the lengthening of the runway to 7,500 feet.

In addition to the Fort McMurray Airport, there are several current and proposed private airstrips in the area that are used to support oil sands operations. Canadian Natural Resources Limited (CNRL) recently completed an airstrip which is used to fly workers in and out of their site from locations across Canada. Imperial Oil Ltd. is also proposing an airstrip to fly workers in and out of its Kearl Lake project.

The increase in air traffic at the Fort McMurray Airport and in the entire Athabasca oil sands region presents a concern for aviation safety. Pending further investigation by NavCanada, air traffic controllers may be required to be reinstated at the tower in Fort McMurray.

Railways

Fort McMurray is served by the Athabasca Northern Railroad (ANR), a short line operator that inter-connects with Canadian National near Boyle, Alberta. In 2005, the ANR handled 16,000 carloads, and this number is increasing. Products shipped include petroleum coke, sulphur, logs, large dimensional loads, and pipe. The latter two are increasing in prominence.

The short line is a private sector transportation service with identified capital improvements. In January 2006, the value of the work required to allow ANR to handle the North American rail standard of 286,000 lb rail cars was estimated at \$250 million. The contemplated work included sledding the line with tie replacement, rail replacement, new ballast and bridge repairs and replacements.

Cold Lake – Bonnyville

M.D. of Bonnyville

There are about 3,200 km of roads and 125 bridges or culvert structures within the jurisdiction of the M.D. of Bonnyville. Almost all of the municipal roads (99 percent) are gravel or oiled roads and only 45 km are paved.

To protect the road infrastructure while still accommodating industrial and commercial road traffic, the M.D. of Bonnyville has implemented policies regarding road bans and

road maintenance. The M.D. implements road bans for commercial and industrial traffic as conditions warrant. All haul routes must be approved by the M.D. of Bonnyville prior to use by commercial and industrial users. Companies using municipal roads for hauling must enter into a road maintenance agreement with the M.D. and a security bond may be required to ensure compliance. The M.D. has been working with companies in the oil and gas industry for the past eight years to find solutions to problems caused by heavy loads being hauled in the district by the oil companies operating in the area.

Town of Bonnyville

The Town of Bonnyville has indicated that approximately \$88 million in road construction and maintenance projects is needed to resolve the existing road infrastructure deficit, including \$67 million for road reconstruction, \$19 million for repairs, and \$2 million for construction of a new road within the community. It should be noted that while the community has identified a significant transportation infrastructure deficit, for the most part, it is not directly related to growth of oil sands developments in the region.

The Bonnyville Regional Airport is located 3 km north of the town and provides air services for commercial, corporate and general aviation. The airport is unmanned and consists of one asphalt runway 4,433 feet long.

Cold Lake

Cold Lake's connecting highways include Highway 28 to Edmonton, Highway 55 to Lac La Biche, and Highway 897 to Lloydminster. The city maintains approximately 140 km of roads within the municipality and plans to spend \$500,000 on road improvements in Horseshoe Bay Estates in 2006 and \$4 million on reconstruction of the English Bay road over the next three years.

Canada's largest military airbase is located in Cold Lake. Regularly scheduled air service is offered by Peace Air to Calgary via Lloydminster and increased service to Edmonton and Fort McMurray is currently under review. Peace Air uses the military runways to accommodate passenger service. In addition to the military base, Cold Lake has a regional airport located 4 km west of the city with one runway 3,000 feet long. The amount of heavy oil activity in the area may create a need for expansion at the regional airport and this issue is currently being studied.

Peace River Region

The Town of Peace River is connected to Edmonton by Highway 2 and Highways 43 and 49. Secondary Highways 684, 986, 743 and 744 also provide access to the town and connect with the major resources in the area, including Diashowa-Marubeni International's pulp mill and Shell's in situ plant.

The Peace River airport was purchased from Transport Canada by the Town of Peace River in 1996. The airport is located 10 km west of the town and has daily scheduled flights offered by Peace Air. There are also a number of charter air services operating out of the airport. The 5,000 foot runway can accommodate 737 aircraft service.

Peace River is serviced by Canadian National Railways on the former MacKenzie Northern short line railway route. This railway line handles approximately 32,000

carloads a year. Cargo includes lumber, pulp, oriented strand board, fuel oil, and grains. While still a short line in 2005, approximately \$60.8 million in capital infrastructure investment was identified for the line.

Looking ahead

Regional Municipality of Wood Buffalo

Anticipated plans for Highway 63 for the next five years include:

- Twinning of Highway 63 from Suncor to Mildred Lake
- Twinning of Highway 63 south of Fort McMurray from Highway 69 to south of Mariana Lake
- Improvements to the traffic flow for downtown Fort McMurray, including a new bridge over the Athabasca River
- Construction of interchanges on Highway 63 in Fort McMurray at Thickwood Boulevard, Confederation Way, in the vicinity of Morrison Street and later at Beacon Hill

Other transportation infrastructure projects in the municipality include:

- Completion of seven truck staging areas
- Construction of an all-weather road from Anzac to La Loche, Saskatchewan

Suncor Energy Inc. plans to construct an overpass on Highway 63 to provide safe access to the existing mine and upgraders on the east side of the highway and to accommodate access to their new upgrader on the west side. The interchange is estimated to cost approximately \$30 to \$40 million and will be completed in 2008.

Preliminary estimates of known projects which are the responsibility of the Regional Municipality of Wood Buffalo indicate that about \$87 million in road construction and maintenance will be required over the next five years. Of this total, approximately \$25 million will be provided through various grants. This estimate is likely low due to potential cost escalations and higher than expected population growth which may place increasing demands for new or upgraded roadways.

Cold Lake – Bonnyville

The Cold Lake Region's highway improvement projects include:

- Widening and repaving of 18 km of Highway 55 at a cost of \$11 million
- Paving of 19.2 km of Highway 657 to be completed in 2007 at a cost of \$6.5 million
- Paving of 3.2 km of Mission Road north of Cold Lake to be completed in 2008 at a cost of \$1.8 million

Peace River Region

Highway improvement projects in the Peace River Region include:

- Completion of the remaining portion of twinning Highway 43

- Repaving and improvements to the intersection of Highway 744 in Peace River at a cost of \$4.8 million
- Five bridge culvert replacements at a cost of \$5.1 million

Transportation Funding

The Athabasca Regional Issues Working Group (RIWG) produced a five-year plan for highway infrastructure in the Regional Municipality of Wood Buffalo. The plan calls for a total of \$1.05 to \$1.25 billion in government infrastructure spending on highway projects between 2005 and 2009. It should be noted that the RIWG estimates were not based on detailed analysis of engineering and construction costs and in some cases the estimates are low due to increasing needs and cost escalations.

Table 8 compares the RIWG requests to provincial government capital commitments. The total capital commitment by the Alberta government is almost \$1.5 billion and exceeds the total of the RIWG requests. However, there are two areas where there are significant differences:

- The twinning of Highway 63 from Syncrude to Fort McKay which currently has no government commitment; and
- The east corridor road which is considered by the Alberta government as a private industrial road and therefore an industry responsibility.

The RIWG estimate of \$200 million for improvements to the urban service area is significantly lower than the actual funding required. The province has committed a total of \$306 million but an additional \$336 million is required for the completion of interchanges and other transportation projects within the urban service area of Fort McMurray.

Table 8: Comparison of Regional Issues Working Group Plans to Provincial Government Funding Commitments

Regional Highways	RIWG Requests (2005-2009)	Committed and Funded to 2009	Committed and Funded to 2011	Committed and Unfunded to 2011	Committed Beyond 2011
Hwy 63 Twinning from Suncor to Syncrude	\$50 M	\$45.6 M	-	\$22 M	-
Hwy 63 Twinning from Syncrude to Fort McKay	\$50 M	*	-	-	-
Hwy 63 Twinning from Fort McMurray to Grassland	\$500-700 M	\$215 M	\$120 M	\$168 M	>\$37 M
Hwy 881 Improvements- paving 881 and widening near Gregoire lake	\$50 M	\$73.3 M	-	-	\$12 M
Hwy 63 Edmonton to Fort McMurray parking/staging areas	\$50 M	\$45.6 M **	-	-	\$3 M
Urban Service Area *** Improvements (Interchanges, bridges, turning lanes)	\$200 M	\$130.5 M	-	\$176 M	\$20 M
East Side Corridor (Industrial Access Road)	\$150 M	*	-	-	-
Total	\$1.05 – 1.25 Billion	\$510 M	\$120 M	\$366 M	\$72 M

* no commitments made

** Includes funding to by-pass Lac La Biche

*** RIWG estimates are low; an additional \$336 million may be needed to complete all projects in the urban service area

Source: RIWG and Alberta Infrastructure and Transportation

Table 9 shows the total capital commitments to the Regional Municipality of Wood Buffalo for all transportation-related infrastructure over the next three- and five-year periods as well as the portion of the commitment that still requires funding approval. Of the \$614 million in total capital commitments over the next three years, \$122 million has yet to be funded by the provincial government. The unfunded commitment rises to about \$394 million in 2006-2011.

Table 9: Capital Commitments in the Regional Municipality of Wood Buffalo

Provincial HWY Network Capital Commitments	3 Year Total (2006-2009)	5 Year Total (2006-2011)
Urban Services Area	\$134,032,000	\$305,432,000
Rest of RMWB	\$417,849,000	\$650,749,000
Other NE Corridor Projects	\$62,025,000	\$74,025,000
Total	\$613,906,000	\$1,030,206,000
Amount Still Requiring Funding Approval	\$122,000,000	\$393,500,000

Source: Alberta Infrastructure and Transportation

Note: Some projects under this heading may not fall within the boundaries of the RMWB.

Key issues

Our assessment of the current situation regarding roads, highways and airports in the three oil sands areas highlights the following issues.

- **Resource Road Program**

The Resource Road Program provides cost-shared grants to rural municipalities for upgrading local roads that are affected by resource development. The funding is cost shared on a 50/50 basis and has a maximum provincial contribution of \$1.5 million per project. In 2006-07, the Government of Alberta allocated \$17 million to the program. The program may be of little benefit for major resource road projects in the three oil sands regions, given the high cost of road construction, the relatively small amount of funding available, and the low maximum contribution per project. Recent provincial government announcements have added \$34 million to the resource road program for 2007-2008.

- **Cost increases for road construction**

On a province-wide basis, Alberta Infrastructure and Transportation has estimated cost increases for roads and bridges of 15 percent in 2007, 15 percent in 2008 and three to five percent in subsequent years. In the Regional Municipality of Wood Buffalo, cost increases are substantially higher than these estimates. The municipality estimates recent cost increases of about 40 to 60 percent and in some cases, as high as 100 percent.

- **East Athabasca Corridor Road**

The industry owned and operated Canterra road which currently serves as an access road to oil sands projects in the east Athabasca region will be mined out under the Albian Sands Muskeg River Mine Expansion plan. This will cut off access to several mining projects including Suncor Firebag, Imperial Kearn Lake, and Synenco Energy. Oil sands industry representatives are proposing the construction of a new road to serve the eastern oil sands projects. Starting from Highway 63 near Syncrude's Mildred Lake project, the road would then cross the Athabasca River and follow Suncor's Firebag pipeline corridor. Under the RIWG proposal, the total cost for this road is estimated at \$150 million.

- **Impacts of heavy oil hauling**

The Cold Lake oil sands region has a number of cold heavy oil projects that are not connected to collection pipelines. The oil is trucked throughout the region to processing facilities for further upgrading. The amount of truck traffic this generates has a negative impact on the roads in the M.D. of Bonnyville.

Observations

There is a strong perception from the residents in the urban service area of Fort McMurray that transportation is a major issue. The volume of traffic has increased substantially since 2000 and road safety is a growing concern. In a recent survey conducted by Archibald Research and Planning, residents indicated that increased traffic was a serious problem in the urban service area and on certain sections of Highway 63.

Alberta Infrastructure and Transportation uses traffic counts to support decisions regarding upgrades to the provincial highway system; however, this does not always work well in areas that have unusual traffic patterns or unique vehicles operating on the roads.

In the Regional Municipality of Wood Buffalo, the traffic is characterized by extremely high peaks in and around Fort McMurray during shift changes and significant peaks on Highway 63 south to Edmonton on Thursday afternoons and Sunday evenings, also as a result of shift changes. The area sees an unusual amount of over-dimensional loads such as modules and cokers. These loads take up a substantial portion of the highway and typically travel at speeds of less than 35 km per hour for modules and 25 km per hour for cokers.

Overall, the provincial government's capital commitments for transportation infrastructure appear to meet the needs of the Regional Municipality of Wood Buffalo. However, a large portion (\$394 million) of the five-year capital commitments still requires provincial government funding approval. This could rise to as high as \$880 million if timelines are advanced for committed projects that extend out ten years. This does not include other identified but not committed projects like the additional \$336 million in provincial transportation infrastructure identified for the urban service area.

Ultimately, the timing and completion of these committed projects will determine the extent to which the province will meet the transportation infrastructure requirements of the region.

Commitments for infrastructure spending are, in some cases, greater than what was requested by RIWG and most of RIWG's key transportation projects are committed and funded. The funding gap is in three main areas: urban service area improvements, twinning of Highway 63 north of Mildred Lake to Fort McKay, and construction of the east Athabasca corridor road.

Basic Municipal Infrastructure

Water Treatment, Waste Water Treatment and Landfill

In addition to roads and highways, the three oil sands areas also need to anticipate the impact of industrial developments and a growing population on their infrastructure requirements for water treatment, waste water treatment and solid waste facilities.

The need for additional municipal infrastructure is directly tied to population and economic growth. According to CERI, almost 95 percent of the total projected investments in the three oil sands regions over the next five years will occur in the Athabasca region. Investment in the Cold Lake and Peace River oil sands regions account for 3.6 percent and 1.6 percent respectively. Given that the bulk of the investment and population growth is occurring in the Regional Municipality of Wood Buffalo, the discussion and analysis will focus on this area. Although the Peace River and Cold Lake oil sands regions have their own unique infrastructure needs and challenges, they are only partially related to the growth of oil sands operations.

Assessing capacity

There are few indicators that offer good comparisons of the infrastructure in the main service centres of the three oil sands regions. One comparison that can be made is to examine the amount of excess capacity that is available at the various municipal facilities. Comparing the design capacities with the current and expected population provides an indication of the amount of growth that can be absorbed by the community before major reinvestments in expansions and upgrades are required.

Table 10 compares the capacity of water treatment, waste water treatment and solid waste facilities for current and projected populations for Fort McMurray, Peace River, Cold Lake and Bonnyville. The table assumes no changes are made to the existing infrastructure over the five year period. It simply indicates the ability of the current infrastructure to absorb projected growth.

A ranking of *moderately over capacity* indicates that the system must be expanded immediately; *under capacity* means there is excess capacity to absorb future growth; *nearing capacity* indicates that the infrastructure will need to be expanded over the next one to two years; and *severely over capacity* suggests the infrastructure cannot support the current population. In reality, the severely over capacity category would not exist due to environmental regulations and the potential system failure. It is important to note that this ranking does not reflect the quality or age of the facility, nor does it show the ability of the regions to meet environmental regulations.

Table 10: Capacity of Basic Municipal Infrastructure in the Three Oil Sands Regions

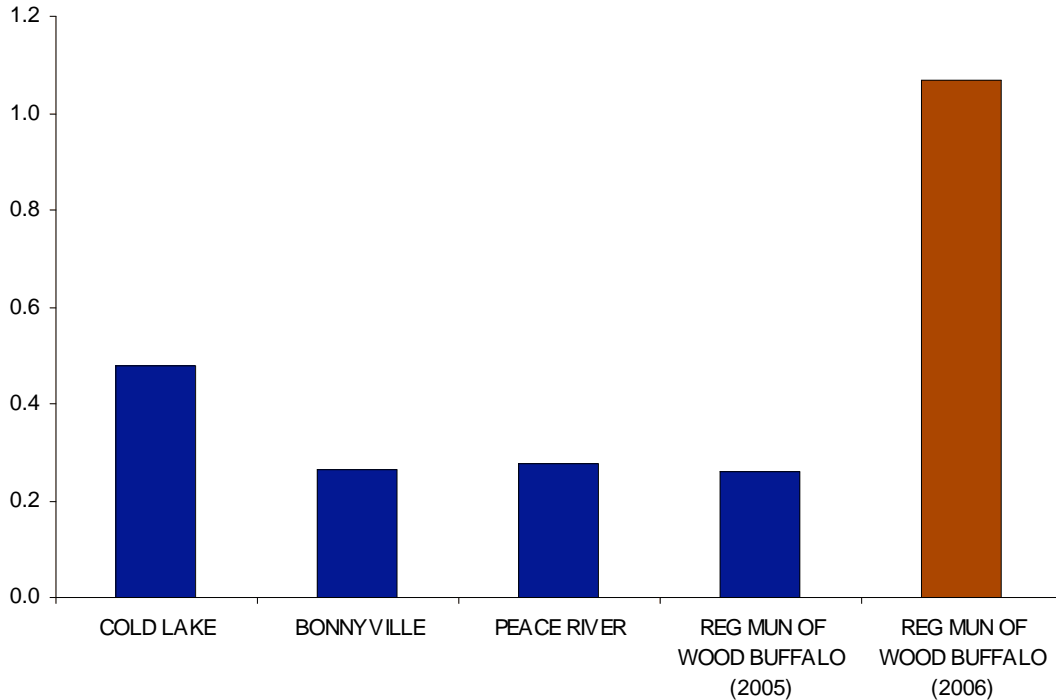
Type of Infrastructure	RMWB (Fort McMurray)		Peace River		Cold Lake*		Bonnyville*	
	2006	2011	2006	2011	2006	2011	2006	2011
Water Treatment Facilities	Moderately Over Capacity	Severely Over Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity
Waste Water Treatment Facilities	Moderately Over Capacity	Severely Over Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity	Under Capacity
Solid Waste Facility	Nearing Capacity	Severely Over Capacity	Under Capacity	Under Capacity	Nearing Capacity	-**	Under Capacity	-**

*The Cold Lake – Bonnyville region is currently investigating the feasibility of developing regional water and waste water treatment facilities. These facilities would have a completion date beyond 2011 (likely 2012 - 2015).

** The Beaver River Regional Waste Management Commission is currently designing regional transfer stations for solid waste. The new transfer stations should be completed in early 2008 and will be owned and operated by the commission.

The amount of investment required to upgrade or expand water treatment and waste water treatment facilities means that most municipalities will require some form of debt financing. The provincial government places limits on how much debt municipalities can carry. Those limits are set at 1.5 times the annual revenue of the municipality. Figure 8 provides an indication of the ability of the municipalities in the oil sands regions to fund future infrastructure requirements through debt financing.

Figure 12: Debt as a Percentage of Allowable Debt Limit (2005)



Note: The allowable debt limit for the Regional Municipality of Wood Buffalo is regulated by the provincial government and was increased in 2006 to ensure the municipality stayed within the regulated limit.
Source: Alberta Municipal Affairs

The Regional Municipality of Wood Buffalo has recently accepted a \$136 million loan from the province for debt financing to support the expansion of their waste water treatment facility. Had the province not increased the allowable limit in 2006, the municipality would have exceeded the limit by seven percent. Regardless of the recent changes to the allowable limit, the municipality has little room for further debt financing for the needed expansions of their water treatment plant which is already over capacity or the solid waste facility which is nearing capacity.

The municipality has requested an additional \$145 million loan from the province on the same basis as the previous \$136 million loan. This is currently under review by the Alberta Government.

Current Situation

Regional Municipality of Wood Buffalo

As noted earlier in this report, the population of the Regional Municipality of Wood Buffalo has almost doubled in the past seven years. The current level of municipal infrastructure was not built to accommodate this rapid and sustained population growth and, as a result, municipal infrastructure is under a severe strain.

All major infrastructure systems within the urban service area must be expanded including water treatment, waste water treatment, and solid waste removal. In fact,

some infrastructure systems such as the water treatment plant and waste water treatment plant are currently over capacity and the municipal landfill is nearing capacity. Although a small infrastructure gap exists today, a significant infrastructure gap will occur unless immediate investments are made in all these areas.

- **Water treatment facilities**

Fort McMurray's water treatment plant is currently over capacity. The plant was designed for a population of 62,000 and the current population stands at 64,442 in the urban service area. Expansion of the facility is needed immediately and will occur in stages. Approximately \$6.8 million will be spent in 2006, \$10 million in 2007, \$7.9 million in 2008, and \$20 million in 2011. In addition, the water treatment plant in the Village of Conklin needs to be replaced at a cost of about \$21 million. This is budgeted for 2007. The southeast regional water supply project, which will include a new water line to Anzac, is also budgeted at a cost of \$26 million.

- **Waste water treatment facilities**

The waste water treatment plant in Fort McMurray was designed to accommodate a population of 60,000 and is currently over capacity. The Regional Municipality of Wood Buffalo has planned a three-phase expansion of the facility. Phase one is currently in progress and is expected to be completed by 2008 for a total cost of \$161 million. This will bring the capacity to 85,000. Given current population forecasts, construction of phase two will be required shortly after the completion of phase one and will bring the capacity up to 100,000, which will be sufficient to 2011. For phase three, construction will need to begin in 2012 and will bring the total capacity up to 133,000.

- **Solid waste facility**

The current solid waste facility is close to capacity. Design of a new regional solid waste facility is nearing completion and construction of the facility will be tendered shortly. The total cost of the project is estimated at \$23 million, with a completion date of 2009.

Cold Lake – Bonnyville

For the five-year timeframe of this report, the population of the Cold Lake – Bonnyville region is not expected to grow at a rate that is significantly different than the average growth rate in Alberta. Existing funding formulae for municipal grants should be sufficient to address the additional infrastructure required for population growth in the Cold Lake – Bonnyville region.

Cold Lake

The City of Cold Lake has indicated that oil sands activity in the area is adding new growth pressures, price escalations for infrastructure projects, and concerns over fiscal sustainability. Due to rising costs, offsite levies to fund infrastructure were increased in June 2006 from \$26,000 per hectare to \$38,000 per hectare. Property taxes in Cold Lake have increased 14 percent per year over the last three years and user fees and other revenue have increased by 23 percent over the same period. Costs for capital infrastructure projects increased 20-30 percent from 2004 to 2005 and 30-50 percent

from 2005 to 2006. The community also noted that the local construction market does not have sufficient capacity to complete the needed infrastructure projects.

Cold Lake has recently completed a \$10 million upgrade to its water treatment plant. The water treatment facility is capable of supporting a population of 24,000 – 26,000. A major upgrade to the city's waste water treatment plant was completed in April 2005 and it now has sufficient capacity to support approximately 18,000 people.

Bonnyville

The Town of Bonnyville has indicated that infrastructure needs have increased in part due to growth in the oil industry. The town is conducting a study to assess the ability of their water treatment and distribution systems to meet 2007 regulations for water quality. While the town has identified a significant list of infrastructure projects (\$174 million), these are mostly related to the age of the infrastructure and previous low quality construction and not to growth in oil sands developments. Bonnyville indicated that escalating costs are affecting their ability to meet infrastructure needs as costs for construction are 20-40 percent higher than in other parts of Alberta.

Peace River Region

As with the Cold Lake region, the Peace River region is not expected to grow at a rate significantly above the Alberta average. The existing provincial funding formulae should be adequate to support the community's growth over the next three to five year timeframe. However, the Town of Peace River has indicated that infrastructure costs are high due to the topography and soil conditions. Shifting soils and annual variations in temperature are causing leaks in water mains and sewer trunks. It is estimated that almost 50 percent of the piped water to residents is lost due to leakage.

Current infrastructure funding

Table 11 provides a summary of municipal infrastructure funding for 2006-2007. It should be noted that funding for roads is included in these totals.

Table 11: Total Provincial Government Funding for Municipalities in the Oil Sands Regions (2006 - 2007)⁷

Area	Location	AMIP* Grant	Other Grants	New Deal for Cities & Communities**	Total Municipal Infrastructure Funding***
Cold Lake Region	City of Cold Lake	\$2,265,113	\$751,336	\$215,943	\$3,232,392
	Town of Bonnyville	\$1,084,228	\$390,462	\$103,370	\$1,578,060
	MD of Bonnyville	\$1,595,189	\$3,121,985	\$152,076	\$4,869,250
	Subtotal	\$4,944,530	\$4,263,783	\$471,389	\$9,679,702
Fort McMurray Region	Regional Municipality of Wood Buffalo	\$12,744,991	\$4,522,076	\$1,215,033	\$18,482,100
Peace River Region	Town of Fahler	\$210,628	\$148,283	\$40,160	\$399,071
	Town of Grimshaw	\$462,470	\$279,446	\$88,178	\$830,094
	Town of High Prairie	\$530,491	\$169,200	\$101,148	\$800,839
	Town of Manning	\$245,574	\$756,270	\$46,824	\$1,048,668
	Town of McLennan	\$152,701	\$48,240	\$29,116	\$77,356
	Town of Peace River	\$1,185,139	\$916,018	\$225,968	\$2,327,125
	Birch Hills County	\$312,239	\$413,293	\$29,767	\$755,299
	Northern Sunrise County	\$441,388	\$3,514,648	\$84,158	\$4,040,194
	MD Big Lakes	\$786,518	\$502,762	\$149,964	\$1,439,244
	MD Peace	\$284,129	\$156,643	\$54,174	\$494,946
	MD Smoky River	\$451,834	\$757,318	\$86,150	\$1,295,302
	Peavine Métis Settlement	\$117,374	\$1,218,033	\$22,380	\$1,357,787
	Gift Lake Métis Settlement	\$153,650	\$104,712	\$14,648	\$273,010
Subtotal	\$5,181,434	\$8,984,866	\$972,635	\$15,138,935	
Provincial Total:		\$600 million	\$386 million	\$57.2 million	\$1.04 billion

Source: Alberta Oil Sands Consultations Fact Sheet

* AMIP is the \$3 billion Alberta Municipal Infrastructure Program

** New Deal for Cities and Communities is a federal program

*** This funding includes grants for roads and other transportation-related projects.

⁷ The 2007 Capital Budget for the Regional Municipality was released after this report was written. For updated figures on capital costs, please refer to www.woodbuffalo.ab.ca/municipal_government/agendas+minutes/pdf_2006/agenda/2006/Dec12/agenda.pdf

Assessing future needs

Regional Municipality of Wood Buffalo

The RIWG Update and Progress Report (December 2005) identified a total of \$1.9 billion for infrastructure requirements for the Regional Municipality of Wood Buffalo over a five-year period. Of the \$1.9 billion, approximately \$1.1 billion is related to infrastructure that is under the jurisdiction of the provincial government, namely provincial highways, educational facilities, health care facilities and affordable housing.

The remaining \$800 million is under municipal jurisdiction for what is deemed to be critical municipal infrastructure projects required over the next five years.

More than 80 percent of the funding for these projects will come from the municipality – 43 percent will be funded through debt financing, 39 percent through municipal reserves, 12 percent through various provincial grants, one percent through federal grants, and five percent through other means (operating budgets, etc.).

The municipality will receive a number of per capita grants over the next five years including \$64 million from the Alberta Municipal Infrastructure Program, \$8.9 million from the federal New Deal for Cities and Communities, and \$1.9 million from a federal Public Transit Fund Agreement. When grants from all sources are factored in, the municipality expects to receive approximately \$81.5 million or about 10 percent of the total infrastructure funding required over the next five years.

Cold Lake – Bonnyville

Stakeholders in the Cold Lake - Bonnyville region are currently undertaking a study to determine the feasibility of providing a regional water treatment plant. The proposal would double the size of Cold Lake's current facility and provide water to Bonnyville, Glendon, local First Nations, and all major hamlets in the region. A proposal is also being developed for a regional waste water treatment facility. The facility is projected to cost approximately \$60 – \$65 million and will provide some recycling of waste water to industry. If approved, the regional water treatment plant should be completed in 2012 and the regional waste water treatment facility should be completed by 2015.

The Cold Lake solid waste facility is scheduled to close in December of 2007. The Beaver River Regional Waste Management Commission is currently designing a regional waste management system that will see new transfer stations in Cold Lake, Bonnyville and five other locations within the M.D. of Bonnyville. The total cost is estimated at \$8 million. The Commission will own and operate the facilities which are expected to be completed in the first part of 2008.

The Cold Lake oil sands region will receive about \$9.7 million in 2006 from the Alberta Municipal Infrastructure (AMIP) program and other municipal infrastructure programs. Over the next five years, the region is expected to receive \$24.7 million in AMIP funding.

Peace River Region

The Peace River region will receive about \$15 million in 2006 from municipal infrastructure programs and a total of \$26 million in AMIP funding over the next five years.

Addressing key issues

Regional Municipality of Wood Buffalo

The key issues in the municipality are as follows:

- **Funding**

Securing the necessary funding to support the infrastructure needs of the rapidly growing population of Fort McMurray is one of the largest challenges. The municipality must invest in major infrastructure expansions and upgrades well in advance of receiving any revenues from property taxes resulting from oil sands developments.

The Regional Municipality of Wood Buffalo has not received any grants, other than those offered to all municipalities on a per capita basis. To assist in financing critical infrastructure requirements, the Government of Alberta has provided a loan of \$136 million (interest free for four years) to the municipality through the Alberta Capital Finance Authority. The financing was expected to cover the costs of a water treatment plant, a tertiary waste water treatment plant, a regional landfill site, and a water line to the community of Anzac. Unfortunately, due to increasing needs and rising costs, the loan will now only be sufficient to cover most of the cost for Phase 1 of the new waste water treatment plant which is now estimated at \$161 million.

Table 12: Required Infrastructure Expenditures for Basic Municipal Infrastructure for the Regional Municipality of Wood Buffalo

Project	Total Project Costs	Grants	Debenture	Reserve/Other
Wastewater Treatment Plant	\$161,000,000	-	\$153,000,000	\$8,200,000
Wastewater Treatment Expansion (2009)	\$35,000,000	\$16,300,000	-	\$18,700,000
Water treatment plant expansion	\$25,000,000	\$190,000	\$23,400,000	\$1,200,000
Southeast Regional Water Supply	\$26,000,000	\$18,900,000	\$5,200,000	\$2,000,000
Regional Landfill	\$20,000,000	\$15,000,000	\$4,800,000	\$280,000
Regional Landfill Recycling Facility	\$ 3,600,000	-	\$3,000,000	\$600,000
Total	\$270,600,000	\$50,400,000	\$189,000,000	\$30,980,000

Source: Regional Municipality of Wood Buffalo

Note: An additional \$52 million in basic infrastructure requirements is needed to cover projects not specifically identified in the above table.

A significant portion of the infrastructure funding requirements for the municipality will come from debt financing. As noted earlier, the provincial government amended the Debt Limit Regulation (AR225/2000) under the Municipal Government Act in order to provide the municipality with higher debt limits. This was necessary to accommodate the \$136 million loan from the province.

A condition of the loan requires the Regional Municipality of Wood Buffalo to include the full amount in its debt calculation. This would have put the community's debt level above the mandated limit had the provincial government not raised the limit to two times revenue. The municipality's own internal guideline sets their debt limit at 85 percent of the provincial limit. This internal guideline was established to allow the municipality to take on additional debt to finance the cost of items that arise due to unforeseen circumstances; however, the guideline may now be exceeded as a result of the provincial loan.

- **Cost escalation**

Cost escalation is a significant challenge. There is a premium associated with building in Fort McMurray, known locally as the "Fort McMurray factor." This is due to competition with major industrial projects for labour, contractors and equipment, as well as the high cost of living in Fort McMurray.

In its submission to the AEUB on the Kearl oil sands project, the municipality stated that a comparison of prices based on successful tenders in Fort McMurray with those in Edmonton and Calgary has shown that, in some cases, premiums can be in excess of 100 percent. Most projects awarded by the municipality are substantially higher than originally budgeted for and, in some examples, this can be more than double the original estimate.

In many cases, only one bid is submitted on a tender for a project. The municipal council reluctantly awards these premium contracts, knowing that re-tendering or delaying construction of the project would likely result in further cost escalations.

The following table illustrates the effect of cost escalations. The rapid increase in the total cost for the waste water treatment facility in Fort McMurray is a result of increasing the capacity to accommodate population growth as well as cost inflation. In 2002, the total cost for the waste water treatment plant was estimated at \$41 million. The current cost is now more than four times the 2002 estimate.

Table 13: Impact of Cost Escalations

Waste Water Treatment Facility	Design Population Assumed	Cost Estimate
1999 Conceptual Review	60,000	-
2002 Conceptual Report	70,000	\$41,000,000
2003 Value Engineering Report	100,000	\$90,000,000
2004 Preliminary Design Report	133,000	\$131,000,000
2005 Phase 1 Contract Award	85,000	\$161,000,000
Plus Phase 2 and Phase 3	100,000	\$65,000,000*
Additions	133,000	-

* Total costs for Phases 2 and 3.

Source: Submission of Intervention of RMWB for Kearn Oil Sands Project, Brownlee LLP; Fort McMurray Infrastructure Review, Associated Engineering

▪ **Financial risks**

There are two major financial risks facing the Regional Municipality of Wood Buffalo. The first relates to the need for infrastructure required to support oil sands development well in advance of revenues generated by property taxes from these major projects. The revenues received by the municipality for the oil sands projects are based primarily on machinery and equipment assessments. Taxes are not collected until the projects start production and, in the case of mining projects, this could take anywhere from three to five years. Significant delays or cancellation of projects would severely impact the municipality's ability to service a large debt load.

The other financial risk is the high level of debt carried by the municipality. The region is in a high growth area with increasing cost pressures. Carrying a debt level that is near the debt limit mandated by the province leaves little room for additional borrowing if cost escalations mean that additional funding is needed to complete infrastructure projects. This puts both existing and future infrastructure projects at risk.

▪ **Planning capacity**

As noted in previous sections, planning for municipal infrastructure has been a major challenge for the Regional Municipality of Wood Buffalo. Updating the various Infrastructure Master Plans will be a major undertaking and will require a significant amount of staff time and resources. Additional municipal staff with the appropriate experience and expertise and greater resources for conducting planning studies may be needed in order to address longer-term infrastructure planning needs.

Observations

The massive scale of the oil sands projects in the Regional Municipality of Wood Buffalo is the main driver of population growth in the region. Historically, forecasts have been highly variable and depend on the timing of oil sands developments. RIWG's Urban Population Impact Model, which is acknowledged by many as the most accurate, was almost 8,000 lower than the actual 2006 population, a 14 percent underestimation.

Future population levels depend on new project announcements, regulatory approvals and timing of construction, all of which are outside the control of the municipality. The highly variable population forecasts make it difficult for them to plan, budget and build the needed infrastructure to meet expected population growth. This is compounded by the difficulty the municipality has had in attracting and retaining the necessary staff with appropriate experience and expertise to provide longer-term infrastructure planning.

Rapid and sustained growth since 2000 combined with the strong population growth expected over the next five years means that all major infrastructure facilities need to be upgraded or expanded immediately. Current infrastructure master plans are no longer relevant and the municipality is currently developing a new transit master plan, transportation master plan, utilities master plan, recreation master plan, and infrastructure master plan.

The ability to fund the necessary infrastructure over the next five years is questionable. The municipality is already at debt levels that are near the allowable limit set by the provincial government and this is after the allowable limit was increased to accommodate the \$136 million loan provided by the Alberta government.

The municipality has indicated that they would like to provide basic infrastructure and services to their residents while incurring the same debt level as other similar-sized communities in Alberta. In 2004, the average debt as a percentage of the allowable limit for Alberta cities was 27 percent. In comparison, the municipality's debt in 2006 would have been 107 percent of the allowable limit had the limit not been increased. Their debt is now at 85 percent of the new limit and they are facing major expenditures for infrastructure upgrades and expansions that are needed now.

Given the rapid escalation of costs for the development of infrastructure in Fort McMurray, it may be unrealistic to expect the residents to bear the full costs. Increases in utility rates and property taxes may help, but that will not solve the funding problem.

While the Cold Lake and Peace River regions have their own unique infrastructure challenges, the population increases currently forecast for the communities within these regions are similar to the provincial average. Existing per capita funding formulae should be able to address infrastructure pressures related to population growth, although it may not solve the infrastructure challenges they face from topography, poor soil conditions, previous poor quality construction, and aging. Most of the impacts from increased activity in cold heavy oil production are on the local road network, particularly in the M.D. of Bonnyville.

The Cold Lake and Peace River oil sands areas will need to be monitored closely in the future. An announcement of a major project or upgrader in these regions may have a dramatic impact on the ability of the main service centres within these regions to provide the necessary infrastructure to support these developments. Much of the land in the Cold Lake region has been leased for oil sands development and the Peace River region has seen lease agreements spike over the last two years; however, company plans for the development of these areas are still largely unknown.

Health Care

Health care is a critical issue to the oil sands regions, particularly in light of growing populations, high risk industrial activity, and the challenge of attracting health care providers to the three oil sands areas. Health care is coordinated and delivered through the Northern Lights Regional Health Authority in the Fort McMurray area, the Peace River area is served by the Peace Country Health Region, and Cold Lake – Bonnyville is served by the Aspen Health Region.

To review possible gaps in health services, several sources of benchmarks or indicators were used, including a benchmark study completed for Municipal Affairs, studies by RIWG, place-to-place comparisons published by Alberta Economic Development, performance measures in government business plans, presentations to AEUB hearings, and data supplied by Alberta Health and Wellness.

Assessing key indicators

Our review of some 17 indicators reveals that, for services delivered within Fort McMurray, health service delivery is lower than average on most indicators (emergency room wait time is one exception).

Health services and satisfaction

The following two tables indicate that there are gaps in health care services available from the Northern Lights Regional Health Authority. They do not have any community health facilities or continuing care facilities in the community, the number of acute care beds is lower than the provincial average, and they have significantly fewer specialists.

Overall satisfaction with health services is lower than the provincial average in Northern Lights, Aspen and Peace Country health regions. And the number of physicians per population also lags behind provincial averages.

Along with other northern Albertans, Aboriginal people are concerned with the pressures on the health care system due to the growth in population in the oil sands regions. These pressures can be exacerbated due to the relative remoteness of many predominantly Aboriginal communities. The transition from traditional to modern lifestyles has contributed to the health status of northern Aboriginal people being lower than other Albertans living in comparable circumstances. Some Aboriginal communities are also concerned that the cumulative impacts of resource developments on the environment may have implications for the health of their people.

Table 14: Indicators of Health Care Services in Selected Communities

Indicator	Province	Fort McMurray urban	Town of Peace River	Cold Lake (Aspen)	Grande Prairie	Lethbridge	Red Deer	Medicine Hat
Hospitals/ Community Facility		1/0	1/1	1/1		1/3	1/2	1/1
Acute beds/1,000	1.9	1.2				2.9	5	3.7
Continuing care facilities		0				4	3	5
Continuing care beds/1,000 Age 65+		34		35		48	50	49
Stay in ER (hours)		1.3			2.7			
Specialists/10,000	8.6	1.3						
Wait times (weeks)								
CT Scans	7	8.9						
Cataract	36	16.9						
Cardiac	18	12.4						
MRI	20	10.6						
All surgeries	30	27						
All MRI/CT	16	15						

Source: Alberta Municipal Affairs Infrastructure Review and Alberta Economic Development "Alberta First"

Notes to chart:

(1) Differing measures taken at differing times by different processes show some variation. Most recent measures used here, usually submissions to EUB hearings.

(2) Wait times measure wait times of Ft. McMurray residents for procedures performed in Edmonton.

Table 15: Selected Satisfaction Levels (percentages)

	Alberta	Chinook	Palliser	Calgary	David Thompson	East Central	Capital	Aspen	Peace	Northern Lights
Overall Quality	72	75	74	72	80	75	73	68*	66*	61*
Easy Access	46	50	50	44	52	49	48	40*	43	38*
Overall Satisfaction	57	60	59	55	65	62	57	55	53*	38*
ER Services	53	51	46*	55*	64	58	44	60	62	43*
Ease of Family Doctor Access.	74	74	76	75	74	65*	76	60*	72	60*
Specialists Access	55	56	54	53	51	63	58	51	57	51
Satisfied	80	74	81	81	74	78	83	72*	82	80

Source: Health Quality Council of Alberta, 2006

Notes to chart:

(1) * marks a significantly smaller satisfaction than at least three other regions

(2) Satisfaction levels for such things as lab tests, diagnostic imaging and pharmacists are also significantly below at least three other regions for Northern Lights Health Region.

Table 16: Doctors and GPs Per 100,000 Population (March 31, 2006)*

Community	Population	Docs per 100,000	GPs per 100,000
Fort McMurray*	50,238	102	68
Bonnyville	10,631	188	151
Cold Lake/Grand Centre	13,932	136	115
Grande Prairie	51,261	178	101
Peace River	9,052	133	133
Lethbridge	74,748	235	139
Medicine Hat	58,487	186	106
Red Deer	82,382	240	119

Notes:

- Population forecast for 2006 is adjusted to the 2005 base registration data, and uses population projections provided by Health Surveillance, Alberta Health and Wellness

- "Cold Lake/Grand Centre" includes the Town of Cold Lake, CFB Cold Lake (Medley) and the Town of Grand Centre.

Sources:

Physicians: College of Physicians and Surgeons of Alberta

Population: Alberta Health and Wellness Population Registry

* Population based on health registrations

Table courtesy of Alberta Health and Wellness

Hospital beds

The number of inpatient beds is an indicator of the capacity of a health region to provide essential health care services. Today, there are significantly more acute care patients being cared for using the same number of beds as there were ten years ago. That is because more procedures can be done on an outpatient basis and more day surgeries are being performed. Many surgeries are less intrusive and have shorter recovery times. The average length of time people stay in hospital has gone down and more patients can be discharged into alternative care facilities and aftercare.

At the same time, a certain number of beds are essential to keep pace with necessary services. In addition, the availability of continuing care beds is an important factor. Without a sufficient number of continuing care beds, people are forced to stay in acute care beds, causing backlogs in inpatient and emergency care.

The following table illustrates the relationship between acute care beds and long-term care beds in service. In a relative sense, Fort McMurray is disadvantaged compared to other northern centers, especially for long-term care.

Table 17: Beds in Service to March 31, 2006

Northern Lights Health Region				
Facility	Location	Acute care	Long term care	Total beds in service
Northern Lights Regional Health Centre	Fort McMurray	102	31	133
St Therese General Hospital	Fort Vermilion	26	10	36
Northwest Health Centre	High Level	20	11	31
La Crete Continuing Care Centre	La Crete	0	23	23
Total Northern Lights:		148	75	223
CCOMPARATIVE COMMUNITIES				
Peace River Community Health Complex	Peace River	30	41	71
Total Peace River:		30	41	71
Bonnyville Healthcare Centre	Bonnyville	23	32	55
Extencicare Bonnyville	Bonnyville	0	50	50
Cold Lake Healthcare Centre	Cold Lake	22	33	55
Total Bonnyville/Cold Lake:		45	115	160
Notice to Reader				
<p>The above listing of Beds in Service was reported to Alberta Health and Wellness by the health authority as operating as of March 31, 2006 (point in time). This information has not been audited. Acute Care beds include Acute Care and Sub-Acute Care beds. Long Term Care beds include Nursing Home and Auxiliary Hospital beds.</p> <p>It is advisable to contact the regional health authority regarding any specific questions.</p>				

Current situation

Northern Lights Health Region

Hospital and community care

The health care system is changing, with less reliance on hospital-based services and more reliance on alternative approaches to delivery. The vision of Alberta Health and Wellness is to rely more heavily on community hospitals and community health centres than on regional hospitals. Under these circumstances, it is argued, the number of acute care beds is not a particularly good indicator of the quality of health services.

However, the Fort McMurray area has no community health centres and only one primary health care network. The only continuing care centre is located at the hospital, although plans are in place and funding is being requested to construct a new continuing care centre in another location. This may mean that the plan for health care in the region needs to be revisited in the short run given the region's current ability to deliver health services and the satisfaction levels of the residents, which are the lowest in the entire province.

Fort McMurray has one hospital, which the Northern Lights Health Region is struggling to maintain as a regional hospital. As Fort McMurray's population grows to 95,000 by 2011, it would seem consistent and appropriate to have a regional hospital for a population that will eventually exceed the current populations of Grande Prairie, Red Deer, Lethbridge or Medicine Hat, all of which will require regional hospitals in the future. The 26 year old hospital in Fort McMurray is in need of some repair, it is too small to accommodate current demands, and it cannot accommodate any physical expansion due to the small size of its land base. The hospital cannot provide parking for staff and visitors at a level commensurate with its use, and its helipad was recently shut down by the federal government.⁸ There are doubts about the ability of the hospital to provide health services in the event of a major industrial accident or other large scale event, or to control any outbreaks that might come with a widespread pandemic (lack of isolation rooms). Despite the need, nothing substantial exists in the government's capital plan to provide relief to pressures currently felt by the region, particularly in Fort McMurray.

Perhaps there is some confusion over how capital improvements get into the government's capital plan. While the health region is responsible for identifying and prioritizing its needs, the request has to be supported by a number of provincial departments or agencies before it becomes a committed and funded project. The mere identification of needs by the Regional Health Authority is not sufficient.⁹ The process for obtaining approval and funding is relatively complex, requiring the development of a preliminary business case followed by a detailed planning study (part of a master plan) before it can even be considered in the capital planning process. For a group that has experienced high turnover at senior and planning levels in recent years, the process likely seems excessively time-consuming and frustrating to the Regional Health Authority, especially for relatively small projects. The process has not worked well for the Northern Lights Health Authority. Of the \$1.5 billion in capital allocated by the provincial government for health care in the last year, only \$3.1 million went to the Northern Lights region, \$2 million of which was tied to the installation of an MRI jointly funded by the community and by industry.

Current capital projects requested by Municipal Affairs in its strategic update submission (as of September 6, 2006) to the capital planning process include some \$119.7 million for ambulatory care re-development, a long-term care facility, and hospital infrastructure modernization.

The municipal planning process also does not facilitate and support expansion of health care facilities. None of the land parcels identified for further development in and around Fort McMurray has land identified for health care reserved for future development in the same way that land is reserved for schools and parks.

Availability of health care providers

Operationally, the greatest issue affecting the quality of service in the region and its continued viability is the ongoing difficulty the region has in attracting and retaining health care staff, both health care professionals and support and custodial staff. While

⁸ The nearest helipad would be downtown at the Fire Department.

⁹ According to Alberta Health and Wellness, the Northern Lights Health Region submitted six projects in its 2000-01 regional plan, only one of which exceeded \$2.5 million (a new long-term care facility). This regional plan was not updated again until 2005-06.

this issue affects all rural areas, and especially the northern areas (indeed, it is a national and even an international problem), Fort McMurray's problem seems particularly acute. The region currently has a 42 percent vacancy rate for physicians. Sixteen percent of non-physician health care positions are vacant. There are nearly 175 vacancies in the region out of a total staff complement of 996 full time equivalents; 138 of those vacancies are in Fort McMurray.

As a result of staff shortages, the Northern Lights health region closed 17 acute and intensive care unit beds and two out of the three operating rooms in the Health Centre at one point in 2006.

The availability of doctors in the Northern Lights region is the lowest of comparably-sized centers and the lowest in the north. Fort McMurray has 102 doctors per 100,000 and 68 general practitioners per 100,000, assuming the population in 2006 is 50,238 (using health registrations). Using municipal census population as the denominator, the ratio for the number of doctors drops to around 79 doctors per 100,000, easily the worst ratio of any of the northern communities and about half the ratio of Grande Prairie, which is considered to be a problem area. The same results apply to general practitioners. Using health care registrations, the number of GP's per 100,000 is clearly the worst in the province. Using census population, the number of GP's per 100,000 is even worse, at around 52 per 100,000 - again about half of the Grande Prairie ratio.

According to material filed by the Northern Lights Health Region at the Kearl hearing, the Fort McMurray urban service area is currently short 15 general practitioners and is expected to need a total of 50 by 2011. The total of all doctors (including emergency room doctors and specialists) for the entire region is currently 49 and the total needed in 2011 is estimated at 132.

In terms of specialists, the focus from Alberta Health and Wellness is on providing access to specialists in key centres (Edmonton and Calgary), reducing the number of specialists in the region, and increasing specialist service through telehealth and Health Link. This strategy seems to be successful, as residents of Fort McMurray reflect similar satisfaction levels for specialist access as those in other regions, and wait times for specialized services seem lower than the provincial average. The latter may be more of a reflection of the level of service provided by Edmonton specialists than the quality of service in Fort McMurray. Furthermore, as Fort McMurray's population continues to increase, the viability of continuing to provide specialist services at a distance may be questionable.

Recruitment to fill current physician vacancies and to respond to future growth levels is a very expensive and labour intensive process, complicated by:

- Very high housing costs
- An inability to pay additional salaries to recognize the special circumstances of the area (in the same way industry and small business does to attract labour)
- Cost of living allowances paid by industry and by the province that cannot be matched with the region's current budget.
- A bleak outlook for health services in the future. (Where there is no agreed upon vision coupled with a commitment to provide the resources to get there, many health care workers may choose to pursue a career elsewhere.)
- Remote location

- Limited access to cultural and recreation opportunities
- Fewer opportunities to interact directly with specialists

Staff shortages affect wait times other than those measured by Alberta Health and Wellness. Physicians from the Northern Lights Health Region indicated in a report to the Alberta Medical Association's fall 2006 Representative forum that:

Due to staff shortages, wait times for in-patient ultrasounds are two weeks and in-patient barium enemas are three weeks. Physicians are forced to take holidays because not enough nurses are available to staff clinics, despite patients waiting up to 20 months (average wait time is 4 – 8 months).

There is low morale across the institution. Obstetrics are overwhelmed and overhead costs are spiralling.

There are no echo cardiograms, EEG, lung or bone scans in the community.

Funding

The formula used by the provincial government to provide funding to the health regions seems to work well for the distribution of a finite pot of money to geographic areas where growth is reasonably modest and the population is reasonably stable. It does not work for the Northern Lights Health Region which has exhibited strong growth over recent years. This is likely due to:

- A per capita formula that begins with “historical health care expenses, population size and population mix within regions and the province as a whole,”¹⁰ using health care registrations and projecting forward. Table 18 shows a comparison of municipal census populations and health registrations. Health care registrations are a reasonable approximation for census populations in all the selected municipalities except Fort McMurray. The discrepancy between health care registrations and census population is a significant issue for the calculation of funding as well as in understanding the difficulty the region faces in providing health services.
- There is an attempt to project the future population, but Alberta Health and Wellness estimates for annual growth in Fort McMurray have averaged in the three percent range, while municipal census population figures have averaged eight to nine percent annually.
- Where population based on registrations has been underestimated, there is no provision to make up the lost funds in future year budgets.

¹⁰ For a thorough discussion of Alberta health care funding, see the Auditor General's Annual Report, 2005-06, p. 136

Table 18: Comparison of Municipal Census and Alberta Health Care Registrations (2005)

Municipality	Municipal Census	Alberta Health Care Registrations	Difference	Percentage Difference
Fort McMurray (Urban)	60,983	47,460	-13,523	-22.2
Grande Prairie	44,631	44,370	-261	-0.6
Red Deer	79,082	76,900	-2,182	-2.7
Lethbridge	77,202	71,720	-5,482	-7.1
Medicine Hat	56,048	57,400	1,352	2.4
Calgary	956,078	959,040	2,962	0.3
Edmonton	712,391	707,340	-5,051	-0.7

Source: Alberta Municipal Affairs and Alberta Finance

Aspen Health Region and Peace Country Health Region

In northern Alberta, most communities have faced difficulties in attracting and retaining physicians and specialists. The physician shortage in both the Aspen and Peace Country health regions reflects many of the same challenges as the Northern Lights Health Region including: isolation, limited or high cost housing, workload, shortage of support staff, inadequate equipment and facilities.

The Peace and Aspen health regions show satisfaction levels only slightly better than Northern Lights. The Peace Country shows the best ease of access to family doctors; the Aspen region is the least satisfied with its specialist services.

The indicators we reviewed show that health services in the towns and cities serving the other two oil sands areas are, in some cases, orders of magnitude better than those received in the Fort McMurray area. For almost every indicator, communities in the rest of the province are better served, whether that is in relation to the number of community facilities, number of continuing care beds and/or facilities, physicians per 100,000 or GP's per 100,000.

Future Situation

Northern Lights Health Region

Recently, Alberta Health and Wellness added some 14 percent to the base budget (an additional \$10 million, approximately) in the form of a cost adjustment factor to the current funding formula. The region also receives \$3.9 million in a northern allowance. However, the health region is still expected to make up any deficit in its budget, currently estimated at \$15 million. This would further reduce staffing levels, perhaps by as much as 110 full-time equivalents.

Most of the larger oil sands projects have medical services of some type on site. Imperial Oil proposes to build a medical centre on the new Kearl Lake site. The Northern Lights Health Region and Imperial Oil have agreed to cooperate in finding mutually beneficial solutions to regional health and medical issues. Albian Sands proposes to build a

medical center at the new Muskeg River project. These types of facilities provide basic diagnosis and treatment of more minor medical issues and prepare more seriously injured or ill workers for transfer to Edmonton. While these clinics certainly relieve some of the pressure on the health care system in Fort McMurray, at least for camp workers, it's not obvious that they obviate the need for more resources in the health region.

Suncor has recently seconded a human resources professional to the Northern Lights Health Region to help with attracting and retaining health care staff in the region.

The Northern Lights Health Region is developing a master plan for the region which will include plans for mental health care, continuing care, and primary care networks, including one in the northwest part of the region. Other studies underway include a community health needs assessment, a human resource plan, and studies of information technology. The health region seems to be headed towards a community-based strategy for primary health care delivery, making use of community health centres, primary care networks, family health units, continuing care facilities, and primary health centers, with a regional hospital at the core. In some ways, this is consistent with Alberta Health and Wellness' long-term vision.

However, it will take quite a number of years to reach this ambitious goal and a good deal of additional funding. In the meantime, it seems clear that something must be done quickly to address the critical issues affecting the region.

Aspen Health Region and Peace Country Health Region

Information reviewed as part of this report, combined with anecdotal evidence provided in interviews and observations as part of our consultations, suggest that some of the same problems exist in Aspen and Peace Country health regions, but they are not nearly as severe.

In Cold Lake, the Minister was told "there are some good hospitals, we are attracting doctors, and we are attracting specialists." The leadership of Aspen Regional Health Authority seemed to agree that the region was not in as critical a shape as Fort McMurray, but "we're next." The feeling seems to be that some time can be bought by doing "little things" in Aspen, but new investment will be need to ensure adequate care in the region. In Peace River, there is a new hospital, although the feeling in the area seemed to be that it would soon be too small. Discussions seemed to focus on new facilities under consideration for Grande Prairie.

Observations

The gaps in health care in the Northern Lights Health Region are the most severe and cut across the entire system. Serious problems exist with the capacity for acute care, continuing care and community care. Any confusion that might exist over responsibility for capital projects needs to be resolved so projects can be considered appropriately as part of the government's capital plans. The region continues to have severe challenges in attracting and retaining the physicians and health care providers it needs to meet current and anticipated demands. And in our view, the current funding formula does not adequately respond to the dramatic growth in population in the region.

While the Aspen and Peace Country regions face some similar challenges, they are not nearly as serious and can be addressed through the regular funding approaches.

Given this assessment, it seems clear that priority investment must be made in the Northern Lights Health Region – in planning, in innovation, in provincial commitment, and in money. This does not mean that the needs of the other two regions should be ignored, but it does mean that Fort McMurray's needs should be addressed with some urgency.

Education

There are four school boards that operate in the Regional Municipality of Wood Buffalo: Fort McMurray Public School District, Fort McMurray Roman Catholic Separate School District, Northland School District, and Greater North Central Francophone Education Region.

The Northland School District extends across northern Alberta and includes the rural area surrounding both the Town of Peace River and the Regional Municipality of Wood Buffalo. There are three school boards operating in the Peace River area: Peace River Public School Division, Holy Family Catholic Regional Division, and Northwest Francophone Education Region.

There are three boards in the Cold Lake – Bonnyville area: Northern Lights School District, Lakeland Roman Catholic Separate School District, and East Central Francophone Education Region.

Keyano College provides post-secondary education and trades training to people in the Fort McMurray area. Northern Lakes College has a campus in Peace River among its 27 locations and Portage College has 13 locations including campuses in Cold Lake and Bonnyville.

Current situation

Student enrolment

In terms of growth in student enrolment, in Fort McMurray the projected student growth rate for 2005-06 to 2006-07 in the public (2.3 percent) and separate schools (1.1 percent) has been well below that of the general population growth for the City of Fort McMurray (8.5 percent). However, both systems are currently operating at or near capacity with few options to accommodate any future growth. The public system is at 82 percent capacity and the separate school system is at 92 percent capacity. The Greater North Francophone school district has the highest growth rate (11.8 percent). Enrolment in the Northland School Division is expected to show a decrease this year.

Peace River public and separate schools are also near capacity although the growth rate has been relatively slow. Again, the growth rate has been highest in the Francophone system. Overall enrolment growth has been minimal for public and separate schools in the Cold Lake – Bonnyville region (except for the Francophone system), although there has been more growth in Cold Lake than Bonnyville.

Generally, the Francophone school systems have small student populations and existing capacity to accommodate future growth.

Table 19 illustrates the average 2005-06 and projected 2006-07 change in student enrolments for school jurisdictions in the three oil sands regions.

Table 19: Average Change in Enrolments and Student Population

Jurisdiction	Percent Annual Average Change since 1996	2006/2007 Student Population (Preliminary)	2005-06 change in student population (Percent)	2005/06-2006/07 Projected student population change (Percent)
Ft McMurray public	0.99	4,630	2.69	2.3
Ft McMurray separate	0.98	4,000	1.39	1.1
Northland	0.09	2,660	-1.71	-0.3
Greater North Central Francophone	6.93	2,200	8.44	11.8
Peace River Public	-1.86	3,300	0.84	0.7
Holy Family Catholic (Peace River)	14.49	2,150	-1.43	-0.3
NW Francophone (Peace River)	2.83	320	4.27	5.9
Northern Lights public	-0.99	5,800	-0.95	-0.9
East Central Francophone	3.94	555	7.83	4.3
Lakeland Catholic	0.99	1,980	0.91	-0.2

Source: Alberta Education statistics

Infrastructure

Fort McMurray has a school/student ratio of one school for 449 students. This is higher than the ratio for Red Deer (1:437), Lethbridge (1:414) and Medicine Hat (1:351) (Source: Infrastructure Review, Alberta Municipal Affairs).

Satisfaction and achievement

School jurisdictions are required to include a number of performance measures in their three year education plans. These measures are related to:

- High school completion within three years
- Percentage of parents and teachers who agree students are taught attitudes that will make them successful at work
- Percentage of parents, teachers and students who agree students model characteristics of active citizenship

The percentage of students completing high school within three years is similar for all jurisdictions, except Holy Family Catholic which is somewhat lower. Completion rates

are lower than the provincial average for all school jurisdictions in the three oil sands regions.

The percentage of parents and teachers who think students are taught attitudes and behaviours that will make them successful at work is generally higher in the separate school jurisdictions. Peace River School Division has a somewhat lower level of agreement than the other jurisdictions.

Parent, teacher and student agreement that students model the characteristics of active citizenship is generally higher in the separate school jurisdictions. Northland School Division and Peace River School Division have results that are somewhat lower than the other jurisdictions.

The overall satisfaction rating of the three regions is high in the Fort McMurray area with good or excellent ratings in five of the nine factors. These factors relate to safe schools, learning opportunities, achievement, preparation for work and parental involvement and continuous improvement.

Table 20: Satisfaction and High School Completion Ratings

Indicator	Percentage of students who complete high school within 3 years	Percentage of parent and teacher agreement students are taught attitudes and behaviours that will make them successful at work	Percentage of parent, student and teacher agreement that students model characteristics of active citizenship
Fort McMurray public	68.6	72.9	70.5
Fort McMurray Separate	68.0	79.9	76.3
Northland School District (rural RMWB and rural Peace River)	18.9	73.7	62.6
Holy Family Catholic Regional Division (Peace River)	61.6	78.6	73.8
Peace River School Division	67.8	66.3	66.2
Northern Lights School Division (Bonnyville/ Cold Lake)	63.4	73.6	72.2
Lakeland Roman Catholic Separate School District (Bonnyville/Cold Lake)	66.1	77.9	79.8
Provincial average	70.4	77	76.8

Source: Alberta Education

Staffing

Both Fort McMurray public and separate school districts are actively recruiting teachers (mainly specialists) from eastern Canada as there is a high turnover rate of staff. Fort McMurray school jurisdictions are less successful than other urban centres at recruiting Alberta graduates. Only 40 percent of new recruits are from Alberta universities compared to 80 percent in other urban centres.

The Fort McMurray public system has a 29 percent annual teacher turnover rate compared with a rate of 4.5 percent in Edmonton and Calgary. This is also substantially higher than the 10 percent turnover rate for municipal staff in Regional Municipality of Wood Buffalo. About 20 of the teachers are leaving due to retirement.

The largest staffing shortage in Fort McMurray is for administrators and teacher aides.

There is also high competition for support staff and for teachers outside the Peace River town area. The Cold Lake – Bonnyville region has a full complement of teachers.

Advanced Education

The colleges in the oil sands regions are focused on meeting community needs either directly, through distance learning, or in conjunction with other partners.

Keyano College has three campuses in Fort McMurray and delivers programming in five communities in northeast Alberta. Their programs include academic preparation, workforce development, trades and heavy industrial, certificate and diploma career, and university transfer programs. They have recently offered a Bachelor of Education degree program for elementary school teachers.

Student enrolment in Keyano College has been flat or declining in recent years.

A measure of performance in five indicators: graduate employment, graduate satisfaction, accessibility, administration expenditures and enterprise revenues has been developed. Keyano College is rated 88/100 which is just slightly above the provincial average of 87/100.

The overall satisfaction rate for graduates of Keyano College in Fort McMurray is 86.2 percent, slightly lower than the provincial average for all colleges (90.5 percent). The percent of Keyano College graduates who are employed is 94.2 percent compared to the provincial average for all colleges of 95.5 percent.

Portage College has a campus in Cold Lake and Bonnyville and offers seven areas of study including trades and technology, business, and human services. The satisfaction with the overall quality of the education experience for Portage College is 95.5 percent.

Northern Lakes College offers certificate and diploma programs including careers in health and human services, resource-based industry, and technology-related occupations. It also offers pre-employment and apprenticeship programs. Satisfaction with the overall quality of the education experience for Northern Lakes College is 90.7 percent.

Future Situation

Regional Municipality of Wood Buffalo

According to modeling done by Alberta Education, the rate of student growth for Fort McMurray schools is expected to increase. This is a result of both the increased number of people moving in as housing becomes more available and the corresponding increase in the fertility rate as young families move into these houses.

The increase in student enrolment will trail slightly behind the increase in population growth. This makes it difficult to plan for the potential influx of new students because the funding formula is based on current rather than projected growth. As a result there is a potential delay in the development of infrastructure until the existing capacity has already been exceeded.

Long-term planning is needed to accommodate potential demand for new schools that could result from increased population due to oil sands growth. In addition to new schools, related supports (e.g. bus drivers and support staff) need to be available in the community.

Alberta Education has recently released the *Schools for Tomorrow* five-year plan outlining future funding for school projects as well as new approaches and methods for addressing school infrastructure needs. This includes:

- sharing schools with other agencies (e.g. child care, recreational services)
- providing block funding to individual school districts from the school capital funding envelope to give school boards greater control over long-term capital investment. Each board would then decide on its own capital priorities.
- allowing school boards to borrow for capital projects
- standardizing designs for schools to reduce construction time and costs
- using a core school model so schools can be adapted as situations change

Some of these options (e.g. sharing school facilities) are being considered by Fort McMurray public school board staff to address future needs.

Cold Lake - Bonnyville

One new school will be needed as well as funding for the expansion of one school in order to meet potential future growth.

Peace River

The majority of funding requested by the Peace River area relate to school modernizations rather than new school construction.

Advanced education

Keyano College plans to add new trades programs to meet industry's needs as they evolve. The courses offered will change as the demand for trades moves from construction-type jobs to operation-type jobs. The Keyano College master plan includes plans for consolidation of facilities at the downtown campus to enhance student services and maximize efficiencies.

Programs to serve new immigrants (e.g. English as a second language programs) will be in even greater demand as more foreign workers move to Fort McMurray to meet labour shortages. Alberta Human Resources and Employment provided funding for a pilot project to support this program but the project has ended.

Portage College has plans for Cold Lake to be the second biggest campus (after Lac La Biche) by 2010. The Portage College Campus in Bonnyville is pursuing access and apprenticeship funding from the provincial government to support their programs. They also are developing video conferencing capability.

Gaps and issues

Staffing

The northern school districts have difficulty attracting and retaining teachers. Recruitment and training takes up a large portion of existing staff time and high staff turnover creates stress for existing staff. It also tends to result in the district having teachers with lower than the provincial average years of experience.

The elementary teacher degree program offered by Keyano College should help address the high staff turnover by preparing local teachers who will be less likely to leave the community than those recruited from elsewhere.

The school boards have arrangements with industry to find jobs for spouses who are teachers. This assists recruitment for both industry and the school districts since both spouses can find employment.

One of the biggest issues for new teachers is finding affordable housing. Both the public and separate districts in Fort McMurray are involved in a program with the Wood Buffalo Housing and Development Corporation to allocate affordable housing units to assist new teachers in finding housing.

The cost of living in Fort McMurray is relatively high and this has an impact on the ability of school boards to recruit new teachers. Salaries are negotiated locally between teachers and local school boards and are paid on a grid based on years of service and years of education. Collective agreements for both the Fort McMurray public and separate systems include a northern allowance for teachers. For the 2006-07 school year, the separate system provides an allowance of \$5,700 per year while the public system provides an allowance of \$3,500 per year. Considering that public school teachers receive a higher salary than their counterparts in the separate system, the overall effect of the northern allowance is similar. (Source: Alberta Education)

Northland School Division provides a northern allowance for teachers in Fort McKay (\$2,190/year) and Fort Chipewyan (\$2,678/year). (Source: Alberta Education)

Funding formula and operating grants

Funding for each jurisdiction is based on a jurisdictional profile model. In addition to base funding that is provided on a student enrolment basis, funding is provided to address the unique circumstances of school jurisdictions and to provide them with the flexibility to negotiate their own teacher compensation contracts.

A number of funding allocations specifically address the costs of operating in northern areas of the province. For example, northern allowance funding is provided to offset the higher cost of operations in northern communities. The further north a school is located, the higher the per student allocation. Funding is also provided to recognize the varying

local costs of purchasing goods and services in different areas of the province. Calculations are based on the spatial price index developed by Alberta Economic Development. School districts have also requested a specific budget allowance to reflect the high cost of housing and teachers' salaries in Fort McMurray.

All school boards received operating funding increases of 3.8 - 6.3 percent over last year's funding. The following table summarizes current operating funding for the districts.

Table 21: Operating Funding for School Boards in the Oil Sands Areas

Jurisdiction	Funding (Million \$) 2006/07	Percentage increase from 2005/06
Ft McMurray Public	41.5	5.3
Ft. McMurray Catholic	34.8	4.6
Northland	24.1	4.2
Greater North Central	20.0	4.8
Peace River Public	32.9	4.4
Holy Family Catholic	19.1	4.9
Northwest Francophone	4.4	3.9
Northern Lights Public	53.6	5.7
East Central Francophone	7.3	3.8
Lakeland Catholic	16.4	6.3

Source: Alberta Education statistics

Infrastructure

Fort McMurray

Funding has been provided for 29 steel framed modular classrooms (three to address enrolment pressure and 26 to replace deteriorated units). Although these modular units provide needed classroom space, there is a limit to how many can be added to a school before other space considerations (e.g. gym space, washrooms, administrative space) limit student numbers.

Much of the funding requested by both school boards has been for school modernization, although seven new schools were proposed. It takes an average of two years to build a school in Fort McMurray during which time costs continue to escalate.

Four new schools and one major modernization were recently funded by Alberta Infrastructure and Transportation. The funding provided includes:

- \$18.3 million for new Anzac grade 5 - 12 school
- \$10.4 million for St. Martha (K – 8 school)
- \$9 million for school renovations
- a new public junior high
- a new separate high school

For the 2006-07 school year, the amount of funding provided for improving and prolonging the life of existing school buildings and to upgrade school facilities in general has increased. For example, Fort McMurray separate school funding for infrastructure upgrades increased from \$1.061 million to \$1.433 million. Fort McMurray public school

funding increased from \$1.315 million to \$1.757 million and Northland School Division funding increased from \$516,000 to \$810,000. In 2006-07, government will increase funding in this area by four times. (Source: Alberta Education)

Peace River

The majority of the districts' funding requests were for modernizations and portables. Funding has been provided for three school modernizations and some school repairs. No funding was provided for new schools.

Cold Lake - Bonnyville

Funding was provided for both new schools and modernizations including:

- the new Cold Lake High School for Northern Lights School Division
- a new Francophone school in Bonnyville
- modernization of Assumption Junior/Senior High School in Cold Lake
- replacement of an elementary school in Cold Lake
- new Portage College facilities in Cold Lake
- Portage College facilities in Bonnyville

Funding was not provided for:

- Phase 3 of Assumption Junior/Senior high separate school
- numerous modernizations

(Source: Alberta Infrastructure and Transportation Capital Plan)

Student Issues

There is a concern about high workforce demand and high wages in the oil sands resulting in students leaving to work prior to finishing high school. Some companies have committed not to hire students until they have finished school. As projects move from construction to operation, students who leave school early will need to complete their basic high school education and get some post secondary education in order to compete for these new job opportunities.

A high percentage of students are bussed leading to some safety concerns as students are picked up and dropped off on rural highways that are becoming increasingly busy with oil sands-related traffic.

The lack of resources for specialized programming has been expressed as a concern (example the Métis counselling program). Drug use is also a key issue in northern schools, resulting in an increasing need for counselling services.

The educational attainment and training levels of many Aboriginal people in northern Alberta, particularly those living on reserves, fall below those of other Albertans. Consequently, northern Aboriginal Albertans do not participate in the economy at the same rate as other Albertans. This has significant social costs, both to individuals and to society as a whole. Aboriginal people want to play a role in Alberta's booming economy and help to meet the current labour shortage in the oil sands and throughout the province. Some Aboriginal groups have suggested specific initiatives to assist their

members in acquiring the necessary skills to enable them to participate more fully in oil sands development. These initiatives would need to take into account their individual circumstances and be delivered as close to their communities as possible.

Advanced Education

Keyano College

Twenty million dollars in provincial funding has been provided towards projects at Keyano College including the cost of a sports and wellness centre, computer networking upgrade, and replacement of the cooling water system. An additional \$27 million has been provided to operate programs. (AEUB presentation by Government of Alberta Panel at Kearl Lake hearing)

The Keyano Master Plan requested \$167 million from 2006-10 of which the following remains unfunded:

- trade and technology expansion
- library expansion
- heart of campus expansion
- student housing
- equipment replacement

Maintenance and upgrading requests by the College were unfunded as the facility condition data collected by Alberta Infrastructure and Transportation showed the College's facilities are in good repair.

In terms of operating funding, in 2006-07, Advanced Education increased the College's general operations grant by \$2 million to support a living allowance for college staff. Base operating grants also increased by six percent. Human Resources and Employment also provided \$1.4 million for aboriginal training and employment programs. Industry has provided some financial support for programs and plays a role in developing the workforce through projects such as internships, cooperative learning and job shadowing. The College had surplus of \$5 million in June 2005.

New facilities approved for Portage College totalled \$8 million in capital funding for Cold Lake and \$8.7 million for Bonnyville.

Observations

The schools at Fort McMurray are currently at or near capacity. Although school districts are managing to "make do" with portables, capital funding for new schools and modernizations will be needed within the next five years. The four new schools recently announced will address a part of the expected demand; however, more schools may be needed to keep pace with the expected influx of new students as a result of new housing and increased fertility.

Much of the gap relates to future expansion needs. Planning for and allocation of funds need to begin now so that sufficient infrastructure is in place by the time the projected housing is constructed and student enrolment increases. Other options, including those

outlined in the *Schools for Tomorrow* plan, should be considered to help address the potential future infrastructure issue.

Increasing the recruitment and retention of teachers should continue to be a priority for school boards. Initiatives such as increased affordable housing, living allowances and Keyano College's program for preparing elementary school teachers should help address this serious issue.

Consideration should be given to reviewing alternatives to the current approach to providing cost of living premiums. This should be done in a coordinated manner with other service providers (e.g. health care, government employees).

Schools in Cold Lake – Bonnyville and Peace River have not experienced high growth rates and are not likely to have significantly increased student growth in the next five years as a result of proposed oil sands projects.

Efforts by Keyano College to tailor programming to the job market could result in increased enrolment and program demands in the future. However, there does not appear to be a serious gap between current needs and funding for the immediate future.

Social Services

Quality of life and availability of key social services in the community are also important factors to consider in preparing for and addressing growth in the three oil sands regions.

The Federation of Canadian Municipalities published quality of life indicators that municipalities are trying to meet or exceed. These include: affordable housing, civic engagement, community and social infrastructure, education, local economy, natural environment, personal and community health, personal financial security, and personal safety. The following review considers some of these issues as an indication of quality of life issues in the three oil sands regions.

Current Situation

Homelessness

The homeless population has increased by 24 percent since the last survey conducted in 2004 by the Regional Municipality of Wood Buffalo. A following chart shows that Fort McMurray has the highest number of homeless people per 65,000 population compared with five major Alberta cities.

Table 22: Homeless Population of Five Major Alberta Cities

City	Population	Number of homeless	Number of homeless/65,000 population
Calgary	1,000,000 (2006)	3436	223
Edmonton	712,391 (2005)	2618	239
Red Deer	82,971 (2006)	128	100
Fort McMurray	64,441 (2006)	441	441
Grande Prairie	44,631 (2005)	179	259

Source: Fort McMurray Housing Needs Count 2006

Fort McMurray has two shelters for the homeless, Salvation Army and Marshall House, which provide space for 149 people. Marshall House is currently serving both overnight and longer-term homeless people. It is currently raising funds to create enough capacity so it can serve up to 100 additional individuals.

The Salvation Army soup kitchen in Fort McMurray served 3,950 meals in January – May 2006 which was a 109 percent increase over the same period last year. (Source: Submission by the Regional Municipality of Wood Buffalo to the AEUB Kearl Lake Hearing)

In 2005-06, the government provided \$500,000 for shelters and homeless initiatives including 72 emergency and transitional spaces in the two shelters in Fort McMurray. \$200,000 was also provided under the Homeless Initiative for 2006-07. A recent \$16 million province-wide program was announced to provide the homeless with the skills they need to transition from homelessness to shelters to renting affordable housing to owning affordable housing. Initiatives with these transition objectives are run by the Wood Buffalo Housing and Development Corporation.

Cold Lake has no homeless shelter although it has one emergency shelter for women fleeing from domestic violence. There has been an increase in homeless people who are not escaping from domestic violence but rather using this shelter as their only option for housing. On occasion, the shelter has more woman requesting shelter than it has capacity. An initiative is underway to raise funds to provide housing for families for a longer term than the 21 day maximum stay at the shelter.

The town of Bonnyville has no homeless shelter. Although affordable housing is an issue, there does not appear to be sufficient need for a homeless shelter. Women in need of shelter go to the Cold Lake shelter.

Peace River also has a women's shelter but no homeless shelter. The Salvation Army may provide some assistance to homeless people.

Child care

There is a general shortage of child care facilities in the oil sands areas.

Fort McMurray has five licensed day care facilities and six day home agencies. Peace River has one day care center and one day home agency. Cold Lake has two day cares and two day home agencies. Bonnyville has no day care facilities although it has two family home agencies. In comparison Red Deer has nine day care centres, 13 out of school facilities and four family home agencies. Lethbridge has 15 day care centres, 11 out of school facilities and four family home agencies. Medicine Hat has 14 day care facilities, 17 out of school facilities, and five family home agencies. (Source Infrastructure Review Alberta Municipal Affairs, Town of Bonnyville website and NADC)

Nannies are also commonly hired for child care especially for those families with more than one child or for those who work long hours. An extended day care subsidy program has been developed to assist families who work extra hours; however, it has had

minimal requests because most centers cannot get sufficient staff to work the extended hours. The Fort McMurray YMCA has extended its hours to accommodate shift workers.

In Fort McMurray there was a waiting list of 200-250 children for out of school/day care; however, this has dropped substantially with a new facility opening up. The waiting list for day care is not a true indicator of demand. Some families will go on more than one list, others will not take employment offers if they cannot find child care, while still others will use unregulated child care. As a result, these families may be on a waiting list for only a short time. Families will also use nursery schools as an alternative to day care services. (Source: Conversation with RMWB employee, Alberta Children's Services Employee)

Child care fees are higher in Fort McMurray (\$845/child/month) than in Edmonton (\$589/child/month) while subsidy rates are the same across the province (\$575/child/month). This makes day care relatively more expensive for families in Fort McMurray.

Generally, industry support has focused on non-profit day care rather than building day care on the work site. This avoids creating two-tier day care in the community as well as the liability, insurance and zoning issues associated with operating a facility.

There is no capacity for day care in the rural areas outside of Fort McMurray.

In general, the Peace River area has increased the number of child care spaces but they also have an issue related to affordable housing for child care employees.

Family services

A number of agencies in Fort McMurray provide support to families including a women's shelter, family violence working group, crisis line, anti-bullying programs, and victim services (provided through the RCMP offices).

Fort McMurray received a \$300,000 provincial grant for Victim Services for January 2006 to December 2008 and \$27,500 for Community Family violence programs.

Cold Lake has a women's shelter for women fleeing domestic violence. The lack of affordable housing means that women who want to leave family violence have few places to go and therefore return to the violent family home. There also are family violence counselling programs, crisis centre and family services programs offered in Cold Lake.

Peace River has a number of self-help/family support services and is currently conducting a social needs assessment in conjunction with the University of Alberta. This survey will be completed in January 2007.

Addictions

Almost 100 percent of those interviewed in a Regional Municipality of Wood Buffalo community survey raised drug and alcohol abuse as a serious issue. (Source: Archibald, Fort McMurray Quality of Life and Social Indicator Review)

The significant influx of single men with no family connections has resulted in a serious problem with alcohol and drug addiction in the Regional Municipality of Wood Buffalo. Some have suggested that, because of serious labour shortages, some employers are more tolerant of alcohol and drug abuse, simply because there is no one else available to do the job.

Two facilities in Fort McMurray, Pastew Place Detox Centre and Mark Amy Centre, provide addictions counselling. An Alberta Alcohol and Drug Abuse Commission office is also located in Fort McMurray and staffed with 6.6 FTE. The office emphasizes prevention activities such as workplace training, presentations to schools, and working with community groups. Since January 2006, the AADAC office has seen a 25 percent increase in the number of clients. Of these 90 percent identify alcohol or other drugs as the primary concern. Thirty-one percent of clients are in the construction industry while nine percent are in forestry/mining/oil. A 2003 study completed by AADAC indicates that the rate of drug-related charges has increased by five times the provincial rate. (Source: Alberta Alcohol and Drug Abuse Commission statistics)

Addictions are also a significant issue in Peace River, Cold Lake and Bonnyville. AADAC has offices in all three towns to provide support for those with alcohol and drug abuse problems. Although the number of clients is increasing, access to counselling services is still reasonable.

In Bonnyville, the Coalition for Addiction Free Living provides awareness, training and networking services to promote a healthy lifestyle. Part of the focus of the programs is to connect people with others and reduce the feelings of isolation that often accompany new people moving in to work in the oil sands.

Community facilities

A key aspect of community life centres around sports and recreation facilities, libraries and museums, art galleries, theatres and museums. The following chart summarizes the facilities currently available in each of the major centres in the three oil sands regions.

Table 23: Community Facilities in the Oil Sands Regions

	Ft McMurray	Cold Lake/Bonnyville	Peace River	Grande Prairie	Red Deer	Medicine Hat	Edmonton	Lethbridge	Prov. Avg.
Libraries #	2 (1planned)	2/1	1	1	2	1		1 (1 planned)	
#/ 10,000 pop.	0.18			0.22			0.23		
Recreation fee index	102	94.5/-	98.9				100		
Pools #	2(2planned)	1/1	2	2	4	3		5	
#/ 10,000 pop	0.18			0.242			0.17		
Ice arena #	3(1planned)	4/1	1	3	6	6		6	
#/ 10,000 pop	0.83			0.95			0.36		0.70
Sports fields#	23				52	50		58	17.07
#/10,000 pop	10.5			13.3			25.7		
Ball diamonds	35				97	49		65	
Art Gallery/ Theatre	0/1	0/0 0/1	0/1	1/2	1/3	1/1		2/3	
Museum	1	0/0	1		5	1		2	
Historic sites	1	0/0	3		1	2		2	

Sources: Infrastructure Review: Regional Municipality of Wood Buffalo; Alberta Municipal Affairs; Alberta First (Alberta Economic Development); Sustainable Community Indicators (Nichols Applied Management)

Future Situation

Homelessness

The Wood Buffalo Housing and Development Corporation (WBHDC) is currently developing a plan to convert Marshall House from an affordable housing complex for short term stays to a shelter/transitional home. This will enable the facility to provide more overnight spaces in addition to the existing longer-term transitional spaces. The facility will also provide support to the homeless in obtaining the necessary skills to transition out of the homelessness programs to self sufficiency. This includes employment services, addictions counselling and parenting skills in addition to shelter, food and clothing.

The WBHDC are requesting \$485,000 for phase 1 (to March 2007) and \$500,000 for phase 2 (to 2012) of the project from Alberta Seniors and Community Supports. Phase 1 will focus on providing necessary services and additional beds to house up to 100 people. There will be minimal renovations. Phase 2 will require funding for day to day operations, staffing costs and renovations to the facility to accommodate up to 250 people. The WBHDC is also looking at other partners, including the Regional Municipality of Wood Buffalo, industry and community groups, for support in this project.

Family services

There has been discussion about the future need for a youth detox centre in Fort McMurray as family stress increases. However, prevention and housing services are a greater priority than a new facility. Cold Lake has indicated a future need for a men's shelter and a youth shelter. (Source: City of Cold Lake Affordable Housing Report 2006)

Recreation and culture

A new recreation centre is being built at MacDonald Island and a Sports and Wellness Center at Keyano College. A third recreational facility is being discussed in the Thickwood area of Fort McMurray to address future population growth. Discussions with Keyano College staff suggest that the theatre is meeting community interests and that there is no need for a new theatre in the short term.

Cold Lake is currently constructing a new multi-use recreation facility with Portage College and plans to attach a high school in the future. The facility will include an indoor sports field, fitness centre and child care facilities

The Town of Bonnyville outlines the following as their recreational needs:

- \$1million for ball diamonds
- \$17 million for a pool
- \$550,000 for playgrounds
- \$250,000 skate park
- trails

(Source: The Infrastructure Challenge –Town of Bonnyville)

Future growth is also likely to create new demand for outdoor recreational opportunities and facilities. Existing parks and recreational facilities in the Regional Municipality of Wood Buffalo may not be able to support rapidly increasing recreational demand. Current provincial parks will face increasing pressure unless alternative recreational opportunities are provided elsewhere.

Issues and observations

Homelessness

The lack of affordable housing and the need for emergency shelters are key issues for Fort McMurray. Homelessness is also an issue in Cold Lake as evidenced by the number of women using the women's shelter for a home.

Homelessness can be a contributing factor to many other social issues including alcohol and drug abuse. However, social issues can also contribute to homelessness. Appropriate accommodations must usually be accompanied by mental health programs, drug treatment programs and counselling to make serious inroads into homelessness.

Although existing shelters may need additional resources, new shelters are not the answer to resolving the homelessness problem. Government assistance to community

programs to assist homeless people in developing the necessary skills to transition to home rental and ownership will contribute to the solution as will ongoing affordable housing initiatives.

Family and social services

The following social factors found in Fort McMurray all contribute to family stress and an increased demand for social services:

- high housing costs
- lack of local community services
- lack of child care spaces
- lack of support from families who are separated when a spouse works in Fort McMurray
- lack of networks of family and friends where there is a large transient/immigrant population
- feelings of isolation in northern communities

It is difficult for agencies to recruit staff to provide the needed social services due to the lack of housing, high staff turnover, competition with higher paying jobs in the oil sands, and lack of child care services. The increased stress, social problems, prosperity gap and lack of social services lead to increased drug abuse and family violence which creates an even greater need for social services.

High levels of family stress, long working hours and reduced time to commit to the community also result in a weak sense of community, increased isolation and increased demand for all social services with fewer volunteers to help out.

Child care

The lack of quality affordable child care limits the ability of some women to enter the work force. The lack of access to child care often results in women refusing employment offers, looking for other child care arrangements, or staying out of the workforce to look after children.

The high cost of space and low vacancy rate of office space in Fort McMurray have also contributed to the low number of day care spaces. Even when office space is available, facilities are often not able to operate at capacity because of staffing shortages.

Affordability is as much an issue as availability of space. The key challenge to creating quality affordable child care spaces is recruiting staff. To find staff, day care operators must pay higher wages which are then passed on to parents, making it even less affordable. Provincial funding for wage increases has helped operators recruit qualified staff and reduce turnover. Additional subsidies for low income families in high growth areas will assist in making child care more affordable. Housing for staff is also an issue.

The large population doing shift work in the oil sands industry means many people work long and irregular hours. It is difficult to find day home or day care services for children when parents are away from home for long shifts. It is also difficult to find adequate staff to work extended hours to meet this need.

Provincial and municipal governments, community agencies and industry all have a role to play in addressing this issue. Further work needs to be done to coordinate the role of all these various agencies in increasing the number of child care spaces. The provincial government role focuses on providing subsidies for low income families and accrediting facilities. Increasing subsidies for low income families in high growth areas would contribute to the solution. Consultations have recently been undertaken by Alberta Children's Services to determine the most efficient way to create new day care spaces (e.g. grants, subsidies, etc.) and who should be involved in creating the spaces (business, government, community).

Addictions

Addictions and family violence issues are a key concern in Fort McMurray. The rapid rate of population growth, the prosperity gap between those working in the oil sands and those working in other areas, and the difficulty of social agencies to hire new staff to provide support services have all contributed to an increase in alcohol and other drug use in the Fort McMurray area.

Although support services are available, they are seriously affected by staffing shortages. In spite of increasing demands for services, the Pastew Detox Centre and Mark Amy Centre have had to close their doors temporarily due to staffing shortages. This has caused further delays in providing clients with needed counselling services

Proposed housing initiatives will help address this issue; however, as long as the sources of family stress in Fort McMurray remain high, addictions and family violence issues will likely remain a serious concern and the demands for social and family services will continue to be high.

Recreational facilities

A shortage of recreational facilities for residents provides fewer opportunities for healthy lifestyles which can also lead to social problems, especially in northern isolated areas where there are relatively fewer recreational options.

Fort McMurray is similar to other jurisdictions in terms of recreational facilities. The new Macdonald Island facility and Keyano sport and wellness facility will help fill the existing demand but there will likely be a need for more facilities as new housing units are completed and the number of families entering the community grows in the next five years.

Consideration should also be given to addressing the increased pressure on provincial parks that could arise from increased growth in the Regional Municipality of Wood Buffalo.

Policing, fire and emergency response

There are three types of policing in Alberta: provincial policing, municipal policing and First Nation policing. The province has responsibility for ensuring adequate policing. This is done in two ways:

- by delegating responsibility for policing cities and towns to municipalities with a population over 5,000 (urban areas)
- by providing direct policing to rural areas in the rest of the province at no direct cost to those municipalities involved.

Urban areas with over 5,000 people have a number of options including providing a stand-alone police service, relying on a regional police services, or contracting for services from an existing police service. The most common form of contract policing is an agreement between the municipality and the federal government. Municipalities with populations over 15,000 pay 90 percent of the policing costs while the federal government pays 10 percent. Municipalities may purchase additional police services through the RCMP if they desire a level over the base level provided by the province.

For communities with fewer than 5,000 people, policing is provided by the RCMP through an agreement between Alberta and the federal government. The province pays 70 percent of the cost while the federal government pays 30 percent. The RCMP Provincial Police Service works closely with municipal and First Nation police services. Municipalities policed by the RCMP may purchase an enhanced level of policing if they want services beyond the base level of services funded by the provincial government.

A municipal police officer may respond to an incident outside of the city or a provincial police officer may respond to an incident in a city. This improves the level of services for both the municipality and the surrounding rural areas.

In addition to policing rural municipalities, the RCMP provides services to the province as a whole including highway patrol, major crimes unit, commercial crime, and emergency response teams. A province-wide tactical team works out of Edmonton to assist other jurisdictions in addressing drug-related issues upon request. This team consists of officers who are appointed to other positions but are called on when needed to work on drug-related issues.

Current situation

Infrastructure

Fort McMurray has plans for a community and a head office RCMP detachment. The new RCMP head office is currently under construction and should be completed in early 2008. Initial estimates of the cost of the facility were \$30 million but the costs have increased to around \$50 million. Plans call for the existing storefront facility to be built in a new downtown location.

A new RCMP detachment building opened in Peace River in 2003. The Town of Bonnyville has an RCMP detachment responsible for policing the Town of Bonnyville, the M.D. of Bonnyville, and Kehewin First Nations. Cold Lake is served by two police

forces – the RCMP and military police. The RCMP cover the area north and south of Cold Lake, Cold Lake First Nations and Elizabeth Métis Settlement while the military police cover the military base.

Other comparable communities (e.g. Medicine Hat and Lethbridge) have only an RCMP headquarters facility. (Source: Infrastructure Review, Alberta Municipal Affairs)

Fort McMurray also has a 20 bed minimum security work camp facility while Peace River has the only other Correctional Centre in the northern region. There is no remand centre in Fort McMurray.

Staffing

The Regional Municipality of Wood Buffalo is a large area. Officers must travel long distances with partners due to safety concerns. This limits both the availability of police officers for back up and the time spent in the community providing crime prevention activities.

The urban services area of Fort McMurray has 98 RCMP members. The rural area, under provincial responsibility, has 16 RCMP members, three of which were recent additions in recognition of the workload and needs of the area. The rural service area also has three First Nations positions, one Identification (i.e. fingerprinting) position, and one Traffic Analyst position. There are a total of 119 members in the Regional Municipality of Wood Buffalo, excluding the Fort Chipewyan detachment.

Peace River has a total of 13 municipal and provincial RCMP officers. Cold Lake has 20 municipal and provincial RCMP officers and the Town of Bonnyville has 16 municipal and provincial RCMP members.

The ratio of police to population in the urban areas is similar in Fort McMurray and Peace River while it is slightly lower in Bonnyville and higher in Cold Lake. The ratio of police to population in the rural areas outside of the major centres is lower in the Fort McMurray rural area than other oil sand areas rural areas. (Source: Solicitor General Statistics) Police to population ratios are affected by factors such as distance and area of responsibility, remoteness, and access to air transport.

Although the Fort McMurray urban service area is busy, relative to other detachments in Alberta, its overall activity is average (without including shadow population numbers). The Cold Lake, Peace River and Bonnyville urban areas are all busier than the City of Fort McMurray. The Regional Municipality of Wood Buffalo (rural area) is similar to Bonnyville and Peace River rural areas but busier than Cold Lake.

Table 24: Ratio of Police to Population and Relative Activity of the Detachments

Municipality	Population per Police Officer	Relative activity (busiest is #1)
Fort McMurray (urban)	779	31/58
Fort McMurray (rural)	197	20/104
Bonnyville (urban)	634	19/58
Bonnyville (rural)	1155	19/104
Peace River (urban)	780	5/58
Peace River (rural)	1015	23/104
Cold Lake (urban)	1288	6/58
Cold Lake (rural)	427	80/104
Grande Prairie (urban)	774	11/58
Grande Prairie (rural)	1950	10/104

Source: RCMP 2004 Rankings

Crime rates

Crime rates vary significantly across Alberta. Crime rates in the Regional Municipality of Wood Buffalo (urban and rural) are in the mid to higher range. The crime rate for urban Fort McMurray is 142 criminal cases per 1,000 population which is higher than Edmonton and lower than Grande Prairie. The crime rate for the Regional Municipality of Wood Buffalo (rural area) is 101 cases per 1,000 population. This is similar to Cold Lake (rural) and Peace River (rural) but higher than Bonnyville (rural).

Table 25: Crime Rate and Criminal Code Case Load

Municipality	Criminal code Crime rate/1,000 population	Case load/member
Fort McMurray (urban)	142	121
Fort McMurray (rural)	101	77
Cold Lake (urban)	163	172
Cold Lake (rural)	107	40
Bonnyville (urban)	256	168
Bonnyville (rural)	54	103
Peace River (urban)	211	188
Peace River (rural)	97	80
Grande Prairie (urban)	208	175
Grande Prairie (rural)	97	155
Edmonton	118	63

Source: Canadian Centre for Justice Statistics 2005

Traffic offences

Increased growth has also raised concerns about traffic safety. Sheriffs now patrol problem highways (e.g. Highway 63) and assist in traffic enforcement.

Fort McMurray has fewer traffic collisions than the provincial average, indicating that the roads are relatively safe. However, the motor vehicle collision deaths are significantly higher in the Northern Lights Regional Health Authority area (19.5) than the provincial

average (12.1). (Source: Regional Municipality of Wood Buffalo presentation to AEUB Albion Sands Hearings)

Impaired driving deaths per 100,000 people are also substantially higher in the Northern Lights Regional Health Authority area (22) than the provincial average (6). (Source: Regional Municipality of Wood Buffalo presentation at Albion Sands AEUB Hearing)

Current provincial funding

The objective of the Municipal Policing Assistance Grant (MPAG) program is to help towns and cities with over 5,000 population that are responsible for providing their own police services. For 2006-07, policing grants and the corresponding increase over the previous year's grants are as follows:

▪ Regional Municipality of Wood Buffalo	\$935,762 (26 percent increase)
▪ Bonnyville	\$247,168 (171 percent increase)
▪ Peace River	\$240,020 (150 percent increase)
▪ Cold Lake	\$292,760 (58 percent increase)
▪ Grande Prairie	\$724,834 (23 percent increase)

Fire and emergency response

Staffing

The Regional Municipality of Wood Buffalo has seven fire departments. There are three fire stations in Fort McMurray including a new station that was recently opened in Timberlea. The remaining fire departments are in the rural areas and are staffed by volunteers.

The Fort McMurray fire department has 150 full-time staff. The main fire station is located four blocks from the hospital. It has a helipad that is accessible for emergencies since the hospital helipad is no longer in operation.

The emergency response capacity of the Fort McMurray region is enhanced through a mutual aid agreement between the municipality and industry members. The agreement between four industry partners and Fort McMurray means that the closest partner provides the first response to an incident. Once the partner with the appropriate jurisdiction is on site, that individual will take over. Kearl Lake will likely be part of the mutual aid agreement when it comes on stream. (Source: Conversation with regional fire Chief J. Carlisle)

Peace River has a full-time fire chief and on-call emergency staff. They have an integrated fire/emergency medical staff with advanced paramedics.

Cold Lake has full time advanced life support ambulance service. They have two fire stations with one paid member and 25 volunteer firefighters on call. Bonnyville has a regional fire department with eight fire stations. It provides fire protection services under contract to Imperial Oil Resources and CNRL Ltd. in addition to municipal fire services. They have five full-time members, four part-time members and 180 volunteers. The

Bonnyville Municipal Ambulance Service provides an advanced life support service with a paramedic vehicle.

In comparison, Grande Prairie provides fire suppression service to the city and surrounding area. It has two fire stations and 55 full-time fire fighters.

Future Situation

RCMP Capacity

The expected continuing growth in the Regional Municipality of Wood Buffalo will potentially result in the need for a new detachment in the Conklin area and possibly one at Fort McKay. If Fort McMurray reaches a population of 95,000 by 2011, the municipality will need additional staffing.

In the past four years, all requests for more resources in the rural areas have been addressed. Nineteen new policing positions are in the planning stages and are expected to be approved shortly for recruitment by 2008. Three additional positions for enhanced policing have been expedited because of the high policing demands of the area. These are to be located to the Fort McKay area and are being funded by the municipality in conjunction with industry. A new position was recently filled in Anzac. Another two positions for the Conklin area for 2008 are being discussed. One new position for family violence is also being considered. And additional provincial position was added to the rural area to complement the three enhanced police positions in Fort McKay.

Cold Lake has plans for one additional RCMP under their Municipal Policing Agreement with the federal government.

Fire and emergency response

In the Regional Municipality of Wood Buffalo, there has been a 30 percent increase in the number of ambulance calls from the estimate in the Municipal Fire Department Risk Assessment study completed by the municipality in 2001. This increase includes the number of calls from industry work sites and camps.

The increased traffic and dangerous goods transported on Highway 63 through the City of Fort McMurray make this a high risk for a dangerous goods incident.

One more fire station is proposed to cover the growth in the south part of Fort McMurray but construction has been delayed until 2008. Another station may eventually be needed for the rural area.

Observations

RCMP capacity in the Regional Municipality of Wood Buffalo

The statistics don't show a large gap in the number of RCMP officers in Fort McMurray per population compared to provincial averages. Although Fort McMurray has

approximately the provincial average in staffing numbers and criminal code offences per member, there is a higher crime rate and it is a relatively busy office. It should be noted that the analysis in this report is based on the detachment being at full strength. In fact, it has an average vacancy rate of 15 to 20 percent.

The number of officers needed will likely increase in the next five years based on predicted population growth for the municipality. This growth will likely continue to include a large number of transient workers.

The municipality has difficulty recruiting new members due to the relatively low wages and lack of affordable housing. The average starting salary for cadets (\$40,000/year) is low compared to starting salaries in oil and gas industry. Low salaries also make it hard for new recruits to find adequate housing.

There is no housing allowance offered by the RCMP to assist new recruits in getting set up. However, the federal government is still considering a request for a salary adjustment to assist new recruits by placing them at the top of their salary grid for their classification when they move to Fort McMurray. (Source: Alberta Solicitor General) This would provide some additional support to assist in paying for housing.

Increased affordable housing will assist in recruiting RCMP staff and increasing the number of senior staff that stay on. The RCMP is involved in a program to provide affordable housing to essential service staff. It has 18 units from the Wood Buffalo Housing Corporation that new recruits can use for one year to get started.

The RCMP also faces challenges in retaining staff. A large number of senior staff move elsewhere once their five-year posting is complete. The RCMP has a relatively high turnover rate (40 percent in four years).

This retention issue results in a relatively large number of junior members. This, in turn, impacts work load because files take longer to complete and senior staff spend more time in a mentoring capacity.

Increased growth has also raised concerns with highway safety. Sheriffs now patrol problem highways (e.g. Highway 63) and assist in traffic enforcement.

Transient population

The primary growth in Fort McMurray's population includes young males aged 18 - 25, the same group that forms the largest proportion of inmates in provincial correctional facilities. The large transient population means less cohesion in the community and less support for those in the community when families live elsewhere. This is reflected in the number of policing issues arising from the transient population compared to the permanent population. Although the high transient population in the municipality has increased policing issues, the issues have not necessarily focused in the work camp areas.

A large transient population also leads to increasing crime rate, traffic accidents, assaults and drug issues. These types of crimes are on the increase in the municipality. A full-time tactical team would enhance the ability of local RCMP to respond to drug-related issues.

An increase in affordable housing units will assist in providing homes for the transient population that may not otherwise be able to afford a place for themselves and their families. Increased social services will also make Fort McMurray more attractive to families. This could help reduce the crime rate from the transient population (and accompanying work load for staff).

Infrastructure

Fort McMurray has inadequate detainee holding cells to house inmates until they can be transported elsewhere. The new RCMP facility will have only four holding cells. A new downtown facility with a storefront, holding cells and remand capacity is needed. Initial estimates put the cost of a stand-alone remand centre at \$104 million over five years.

Environmental impact

Unlike other areas highlighted in this report, environmental impacts are not necessarily about gaps in services. There is an environmental assessment process in place that is designed to identify negative impacts on the environment. However, we have included comments about the impact of oil sands projects on the environment because of the significance of the issues, their impact on social and economic factors now and in the future, and the need to provide sufficient capacity to address these concerns in the next few years.

Water and water-related issues

One of the biggest environmental concerns is with the amount of water used in the oil sands and the impact of developments on both the quality and quantity of water. The oil and gas industry's use of water is regulated through a system of licensing and monitoring under Alberta's *Water Act*. Under current licenses, the oil and gas industry is allocated just over seven percent of all the water licensed in Alberta. All water license applications are screened by Alberta Environment prior to issuing the license.

About 80 percent of the recoverable oil in the oil sands is extracted by what are called "in situ" methods. The primary method of in situ recovery involves injecting steam to heat the bitumen so that it can be pumped to the surface. The National Energy Board stated in a June 2006 oil sands publication that, "between 2 and 4.5 barrels of water are withdrawn, primarily from the Athabasca River, to produce each barrel of synthetic crude oil from mining operations."

Although recycling occurs, a portion of the water used ends up in tailing ponds. Dewatering mine sites to avoid flooding and the use of fresh groundwater for in-situ operations also have an impact on water tables and wet lands in the region.

Over the long term the Athabasca River may not have sufficient flows to meet the needs of all the planned mining operations and maintain adequate instream flows.

In January 2006, Alberta Environment released a document entitled *An Interim Framework: Instream Flow Needs and Water Management System for Specific Reaches of the Lower Athabasca River*. That report indicates that water sharing or other integrated water management options will be required to meet limits on withdrawals during low flow periods. Alberta Environment and the Federal Department of Fisheries and Oceans have directed the oil sands industry to submit a plan for meeting the requirements of the Phase 1 Framework. Both the provincial and federal departments will ensure that Phase I requirements are met by industry. Current applications before the Alberta Energy and Utilities Board require strategies such as 30 day off stream storage and the ability to fill that storage quickly during high flow periods.

Ongoing efforts will be required to reduce fresh surface and groundwater use, increase capacity for water storage, and reduce water withdrawals from the Athabasca River, especially during low flow periods. Draft water quality objectives for the Athabasca River are expected in early 2007 and will be considered by the provincial government in determining thresholds for water quality and quantity.

Water is clearly a limitation to development and a serious environmental concern. Industry is taking steps to reduce water requirements through recycling and to use saline or brackish water instead of fresh water. Continued efforts will be required to develop new technologies that reduce the overall amount of water required during the extraction process.

The supply of water may also be a concern in the Industrial Heartland as those projects proceed. Alberta Environment has not had the opportunity or the resources to undertake a review to determine whether there is sufficient water available from the North Saskatchewan River to support these upgraders.

Emissions and climate change

The oil sands regions are among the largest emitters of greenhouse gases in Canada. Although significant progress has been made in reducing the amount of greenhouse gases (GHGs) per barrel of bitumen produced, the total production of GHGs is increasing as bitumen production and processing ramps up to well over a million barrels a day.

A number of options are possible for reducing emissions in the oil sands, although most are costly and a considerable investment in technology will be required. It is feasible, for example, to capture the carbon dioxide, pipeline it to areas where it can be used to enhance conventional oil recovery or to sequester it underground. Use of carbon dioxide for enhanced oil recovery could increase recovery rates significantly and provide economic incentives while addressing the GHG emissions issue. A consortium of companies, in conjunction with provincial and the federal governments, is working on how to develop, build and manage an environmentally sound means of capturing, transporting and storing CO₂. Appropriate policy and/or legislative frameworks related to handling and reducing CO₂ emissions would create a market incentive to stimulate more progress on this issue.

Oil sands operations are large users of natural gas to provide energy for mining, in situ and upgrading. New technologies have been introduced and others are being developed which will reduce energy consumption per barrel of bitumen produced and upgraded.

Other options could include the use of alternative and cleaner burning energy sources in the oil sands.

Additional policy incentives to promote the use of best available technology that is economically available would contribute to ongoing continuous improvement in technology.

Land use and reclamation

Land disturbance and reclamation are key issues.

Although mining and in situ production have different impacts on the land, both leave a sizable footprint on the landscape. Steps are being taken to reduce the size of footprint; however, improved coordination among oil sands companies, the provincial government and the forest industry is required to further reduce the impacts on the boreal forest and wildlife. As it stands today, oil sands developments have resulted in fragmented and isolated islands of natural habitat.

While efforts are being made to reclaim mined areas, critics say that the amount of reclamation is not sufficient. There are also concerns about the inability to reclaim wetlands back to their original condition and the productivity of reclaimed mined areas and tailing pond areas. Soil conservation needs to be coordinated with mine plans to ensure proper placement of soils for later reclamation activities. The Alberta government is putting new standards in place for seismic, well pad construction and reforestation which will reduce impacts on the land base.

A number of initiatives are currently being developed that will have an impact on land use in the oil sands regions including the provincial Land Use Framework, Integrated Land Management Program, and regional planning tools. These are designed to provide an overall framework for land use in the province, to coordinate activities among government departments, and to provide more effective planning on a regional basis.

Cumulative impacts

Aside from the individual impacts of oil sands developments on air, land and water, many suggest that the current policy frameworks are inadequate to address the cumulative effects associated with a series of individual projects. This includes assessing the combined impact not only on air, land and water, but also on endangered species such as the boreal caribou as well as the social impact on traditional hunting and fishing lifestyles of Aboriginal peoples. Further work is needed to develop the right tools and methodologies to assess cumulative impacts over time.

Managing environmental issues

A number of organizations have been formed to review, monitor and address environmental matters. Organizations in the Fort McMurray area include the Cumulative Effects Management Association (CEMA), the Wood Buffalo Environmental Association (responsible for monitoring air quality), and the Regional Aquatics Monitoring Program (responsible for monitoring water quality). The Lakeland Industry and Community Association operates an air monitoring program in the Cold Lake oil sands area. In the

Peace River area, air quality is monitored by industry and reviewed by Alberta Environment.

Multi-stakeholder processes play a valuable role in the decision-making process. Many of these multi-stakeholder processes rely on a consensus decision making. The effectiveness of the decision is both enhanced and limited by this approach. Where consensus is possible, the process is valuable to all those involved. However, with controversial issues, a consensus approach can result in decisions being watered down to the extent that they do not meet the best interests of any party or the environment. There also is an incentive to delay the decision making process as long as possible. The default position is that the issue is forwarded to Alberta Environment or another regulator for a decision. This provides additional work load for the department often after a long period in the consensus building process and after positions have hardened.

Careful consideration should be given to the type of decisions that are put into the process and the length of time decisions are allowed to remain in the consensus process. Certain issues are best addressed by the government after stakeholder consultation but without a long consensus building process.

In addition, existing government resources are severely strained as a result of the large volume of work involved with an increasing number of EIAs.

Drawing conclusions

A number of lessons can be learned from the manner in which the province has identified, managed and responded to unexpected and unprecedented growth in the oil sands areas. These lessons call for new approaches to future planning, decision-making and coordination activities of the provincial government.

1. The overall planning and decision-making process within the Alberta government is deficient in some respects.

In periods of stable growth, the planning system that has evolved over time works well. Under normal circumstances, it is a complex but generally effective system which depends on an effective monitoring of social and economic trends by both elected and non-elected officials and a decision-making system in which elected officials make decisions based on the most important priorities. It has not, however, worked as well as it could for the oil sands area in a period of unexpected and unprecedented growth. To ensure the system works well in periods of high growth as well as periods of stable growth, some changes are necessary.

Funding formulae

No amount of available cash would satisfy all the demands for funding that come before the decision makers in government. As a result, various formulae have been devised to fairly distribute the available funding. In times of stable growth and slow changes in population, these formulae work reasonably well.

In the oil sands area, health and education are two important categories of funding. Both have formulae which suffer from weaknesses in times of high growth.

Health funding for future services in Fort McMurray is aggravated by an unexplained and worrisome difference between population figures used by Alberta Health and Wellness and municipal census figures obtained by on-the-ground counts. The difference between these two versions of reality could have made a difference of some 22 percent in base funding for the Northern Lights Health Authority. Coupled with an inability of the current formula to make up for underestimates or inaccurate projections of growth during the current year, the health region finds itself falling increasingly behind in obtaining the funds it requires to stay abreast or ahead of rapid growth.

Both health funding and education funding have adjustment factors that recognize extraordinary circumstances. Education grants can be adjusted by a number of factors including: enrolment decline or enrolment growth, First Nations, Métis and Inuit education, distances to provide services within the jurisdiction, northern allowance, relative cost of purchasing goods and services, and others. As well, additional targeted funding is available for specific provincial initiatives.

The health funding formula also has modifiers, but in our view they seem less effective in keeping up with the demands of high growth than those used in education. Once the basic allocation (which takes into account demographic and illness levels) is developed, non-formula adjustments include:

- Import/export adjustments
- Cost adjustment factors
- Minimum guarantee adjustments
- Alternate payment plans
- Acute care adjustments
- Mental health transfers

The basic health funding formula is fundamentally a population and demographics based methodology which essentially creates some type of provincial average which then has to be adjusted by modifiers. Without modifiers, the approach, as the Auditor General says, “does not fairly address all health care situations”¹¹ and, in our view, likely would actually result in under funding in high growth areas. Thus the remaining question is about how well these modifiers actually work in delivering a necessary response to high growth. It can easily be argued that they haven’t worked very well for the Northern Lights Health Authority.

Population forecasts

Reluctance to use growth forecasts may be due in part to an absence of reliable forecasting models in government departments. A number of departments have population forecast models including Human Resources & Employment, Finance, Health, and Education, but none seem universally accepted by all departments. The lack of a universally accepted population model can hamper coordinated planning if different departments are using different data to analyze the same problem.

In the Fort McMurray area, the population forecast model used by Nichols Applied Management Ltd. in support of the RIWG business analyses seems quite accurate when reviewed against the actual growth of population in the Athabasca oil sands region over time. Its application for other regions was tested first for purposes of this report.

Capital and operating disconnects

There does not appear to be an automatic linkage between capital requests and operating funds necessary to support the new or existing capital improvements. For example, new highway construction funding sometimes appears to be at the expense of necessary maintenance of existing roadways. Infrastructure and Transportation feels it necessary to maintain some 1,800 km of highways per year, but has only been able to maintain some 400 km per year on a consistent basis.

There also seems to have been some confusion over time about the process for requesting capital spending on health projects in the Fort McMurray case. And it is not at all clear whether a decision to build a new health facility (or even to find space where some services now handled in the hospital can be transferred to free up space in the hospital) will be automatically matched with additional funds for operating that facility if it cannot be linked to the funding formulae. When the community raised money to purchase an MRI unit for the Fort McMurray hospital and the province provided some funding for its installation, it was not at all clear how future operating costs were to be

¹¹ See Auditor General’s 2005-06 Report, Volume 1, page 140.

covered. It is likely that the Northern Lights Health Region would have to find the operating costs within its current operating budget.

In his 2005-06 Annual Report the Auditor General noted that:

... the reality is that RHA's now spend all of their operating funds delivering services with their existing capital structure. Opening a new capital facility while maintaining existing facilities will usually require more operating funds. For example, the region will hire more staff, pay for more goods and services, and use more utilities to run the new facility. Yet given the mechanics of Global Funding, that RHA will not receive more funding because its population has not changed. At the very least, changes in service delivery and population characteristics will take two years to run through the Global Funding methodology. This scenario increases the risk that a RHA will generate an operating deficit. Historically, the Department has covered RHA's deficits. (Page 157)

Integrated decision making

For the most part, provincial government departments are doing a good job of monitoring social and economic conditions throughout the province. Information does exist in every department about the trends, issues, problems and potential solutions to myriad issues. But the information does not seem to be regularly packaged in a cohesive, coordinated and comprehensive way that allows decision makers to address an issue in an integrated fashion. And even when that does happen, as in the case of the report prepared by a multi-department committee in response to the original RMWB Business Case in 2003, it is not always immediately apparent what decisions, if any, resulted at the central decision-making level.

In high growth areas, a number of service and infrastructure issues need to be addressed at the same time in order to avoid the types of gaps that are evident in Fort McMurray. The AEUB panel remarked in its November 14, 2006 decision on an application from Suncor Energy Inc. that: (Decision 2006-112):

In past decision reports, the Board emphasized the need for a reliable source of information on the social and economic challenges facing the region and acknowledged the role of RIWG and other regional issues management forums have played in advancing socioeconomic issues. The Board also suggested that a process is needed that takes this information and provides a coordinated and effective channel through which regional and cumulative socioeconomic impacts can be addressed in a meaningful and demonstrated way. A coordinated approach is still not evident. (Page 13)

Environmental management and coordination

The major environmental issues facing oil sands production include the amount of surface and groundwater consumption, the overall impacts on surface and groundwater quality, the release of greenhouse gases and other air emissions, land disturbance and reclamation, and the impacts on wildlife. Existing initiatives (e.g. RSDS and the water strategy) and new initiatives (e.g. instream flow needs framework, integrated land management, land use framework and wetlands policy) are being developed to address

some of these issues. There is still a need for ongoing efforts to reduce water use, enhance reclamation, and reduce greenhouse gases.

Current policy frameworks need to be revised to address cumulative effects. The right tools and the right methodologies must be available. Regional planning tools that set objectives for decision makers based on cumulative impacts should also be established. This could replace the current system of making decisions on a case-by-case basis using plans that simply outline the types of activities that can be undertaken on a specific land base.

Policy incentives to promote ongoing continuous improvement and use of Best Available Technology Economically Achievable (BATEA) would assist in the development of new technology.

It should be noted that many of the environmental issues also have social impacts on the traditional hunting and trapping lifestyle associated with aboriginal communities that must be considered and assessed.

Equity and business decision making

In government, resources need to be directed to a variety of needs, to various locations, often at the same time, and the call on finite resources can be overwhelming. A frequent response to such pressures is an attempt to spread available resources over as many demands as possible, even if no one demand is met adequately. This preoccupation with equal access to funding can interfere with priority setting and is in many ways incompatible with good business decisions. A good business decision may mean that some local demands may not be met until the necessary investment in other areas has been made to support future returns.

2. Coordination between the province and its agents can be improved.

There are examples of a lack of appreciation of the impact of decisions taken at the provincial level on the operation of public agencies that also depend directly on provincial funding. The decision to offer provincial government employees extra allowances and benefits to work in Fort McMurray was clearly a good decision to ensure that the provincial government can attract and retain employees in the area. But it was made apparently without regard to potential dislocations or distortions in the public and separate school boards systems, Keyano College, the regional health authority or the RCMP.

3. Planning for growth resulting from oil sands development is adequate in some respects and deficient in others.

From the gap analysis in the previous chapter, it seems that planning for oil sands development and the appropriate delivery of infrastructure and services has been adequate in some areas but not in others.

Areas where planning has been adequate include:

- **Policing**

The relative ratio of RCMP members/population in the Regional Municipality of Wood Buffalo is in line with the provincial average. However, the municipality has a relatively high work load per member and a relatively high crime rate. The new positions allocated to this region will help address some of these issues, although there will likely be a need for more members in the future with the increased number of projects and the associated growth in transient population. Lack of adequate social support services and affordable housing lead to increased community isolation and family stress. These issues need to be addressed to reduce the crime rate and officer work load.

Other new initiatives such as providing affordable housing for new recruits and paying new recruits at the top of the salary grid for their classification will also assist in retaining staff and providing more senior staff to address workload issues.

- **Recreation**

The index of recreational services shows Fort McMurray is close to other similar-sized jurisdictions. New facilities are being built which should address some of the current gaps. However, as the population increases in the future, new facilities, especially sports fields and ice arenas, will likely be needed. These services are important to maintain the community cohesion necessary to address and prevent other social issues.

- **Education**

The student growth rate in Fort McMurray has been relatively flat for public and separate schools. Schools have been able to “make do” but are currently operating at capacity. Portable classroom space provides a short-term solution after which other factors (e.g. gym space etc.) limit student capacity.

Proposed new housing will bring in more new families with children and will contribute to an expected increase in the fertility rate. These factors point to the need to plan now for increased school capacity in the future. The new schools that have been recently approved will assist in meeting this anticipated growth; however, funding for future modernizations and additional new schools may also be needed.

Workforce shortage is an issue in the education system. Affordable housing initiatives, active recruitment outside Alberta, staff living allowances, and the new elementary school teaching degree program offered at Keyano College will assist in addressing this issue to some extent but it will likely continue to be a problem in the future.

It is also clear from the analysis in the previous chapter that there are several areas in which provincial planning systems have not forecast potential problems developing within high growth areas such as Fort McMurray and have not, as a result, been able to provide solutions in advance of the problems becoming serious deficiencies. These can be summarized as follows.

- **Housing**

The severe housing shortage in Fort McMurray needs to be addressed on an urgent basis. A massive amount of planning needs to be undertaken as soon as possible. This likely requires the province to provide assistance to the Regional Municipality of Wood Buffalo to undertake a series of comprehensive planning processes. Although a number of planning processes need to be completed so that development priorities can be set, there appears to be sufficient land identified to meet housing requirements through 2011 and beyond.

Once area structure plans are complete, the province will need to make land available for housing development. Provincial land sales in the Fort McMurray area need to continue to include conditions regarding the pace of development as well as provision for affordable housing.

While the provincial government has moved to ensure that space for affordable housing will be available in new housing development land, no money has actually been budgeted to ensure that it happens.

Although the Peace River and Cold Lake – Bonnyville areas are currently facing housing shortages, it appears that these issues can be addressed through normal market channels and affordable housing programs. Development in these two regions should be carefully monitored to ensure that proactive planning takes place, especially if the pace of development increases in the future.

- **Basic municipal infrastructure**

The ability of the Regional Municipality of Wood Buffalo to fund the critical infrastructure projects needed for water treatment, waste water treatment, and solid waste is in doubt. Without some form of special funding from the Alberta government, it is unlikely that these projects will be completed in a timely manner that ensures the health and safety of residents in the region.

- **Transportation**

There is some urgency to improve the traffic flows throughout the region. However, the priority should be on the section of Highway 63 from the junction at Highway 881 and north to Fort McKay. Traffic volumes are higher on this section of the highway and are expected to grow substantially as oil sands projects north of Fort McMurray begin to ramp up. While the provincial government has commitments that address a substantial portion of the transportation requirements, much of this is still in the design and planning stage and a significant portion remains unfunded.

A key bottleneck in the urban service area is the bridge crossing over the Athabasca River. There is only one route allowing traffic to move from the residential area and the oil sands plants north of the river to downtown Fort McMurray and this is the cause of much of the congestion.

- **Health services**

By 2011, Fort McMurray will be a city of approximately 95,000 people, larger than the current population of Grande Prairie, Red Deer, Lethbridge, or Medicine Hat. But without significant investment now in health planning, health funding and health capital spending, it will continue to have an inadequate level of health services for a population of its size.

- **Industrial Heartland issues**

The development of new upgraders, expanded upgraders and other industries in the rural municipalities northeast of Edmonton is proceeding at a pace that has exceeded expectations. The primary issue around infrastructure is road related. However, the current capital plan of the government has no provision for additional infrastructure in the area, and the industry complains about a lack of provincial involvement in planning.

Good information about the availability of surface and groundwater supplies to support the developments in the Industrial Heartland appears to be lacking.

- **Social services issues**

Homelessness and lack of affordable housing will continue to be major contributors to social issues in the Fort McMurray area. New affordable housing and programs to assist homeless people in transitioning from community programs to self sufficiency will assist in reducing the number of homeless. However, enhanced social services to provide child care, family violence prevention programs and addictions support services are currently needed. Enhancement of these services will assist in addressing other issues such as lack of workforce and increased family stress which place a burden on currently limited support services.

4. Provincial and municipal responsibilities and funding capacity do not always match.

The province has worked hard to clearly define the obligations of municipalities, and has recognized its obligations to assist with additional financing for projects of mutual benefit to the province and the municipality.

Material provided as background for the multi-stakeholder oil sands consultations that began in September of 2006 established that:

- For the Fort McMurray area
 - The Fort McMurray region is expected to be the recipient of \$64 million over the next five years from the \$3 billion Alberta Municipal Infrastructure Program. Current year commitments are \$18.5 million.
 - The province has committed to the twinning of highway 63 from the highway 55 junction at Grassland for an estimated \$680 million,¹² to which the federal

¹² With recent cost escalations, this figure may reach \$1 billion by the time the highway is complete.

government has now pledged \$150 million. Other projects either completed or underway add to \$202.5 million, including a new bridge across the Athabasca river estimated at \$80 million and major intersection improvements within the urban service area for some \$18.5 million. This does not count the construction of four future interchanges within Fort McMurray.

- For Cold Lake – Bonnyville region
 - Highway improvements committed for the Cold Lake Region totalled \$19.5 million for 2006 – 2007.
 - Municipal Infrastructure funding committed for the next five years will total \$24.7 million, plus an additional \$9.7 million in the current year.
- For the Peace River region
 - Highway infrastructure improvement projects near Peace River and in the region add to \$9.1 million. Projects in the High Level area and the High Prairie area add an additional \$32.3 million to the total.
 - Municipal infrastructure commitments for the next five years will total \$26 million. \$15 million is committed in the current year.

Other recent infrastructure and municipal supports for Fort McMurray include the release of some 670 acres of Crown land for housing; \$31.6 million for school and school-related projects; and \$20 million for projects at Keyano College. An interest-free loan of \$136 million, providing interest savings valued at \$7 million per year for four years, was provided to the municipality for assistance in financing the upgraded wastewater plant.

Despite these commitments, additional capital projects will require financing in the Fort McMurray area. In March of 2003, RIWG estimated necessary capital expenditures at \$1.2 billion to 2009 (including some \$500 million in provincial highway projects), a figure which had risen to \$1.9 billion by December of 2005 (including \$500 million in provincial highways projects).

In the case of Fort McMurray, the Regional Municipality of Wood Buffalo does not have and will not likely be able to raise the kind of revenue it requires in the time available to provide the infrastructure and services necessary to support the development of a resource which is clearly of such benefit to the entire province.¹³ It is, perhaps, unfair to expect a relatively small regional municipality to undertake all of the investment necessary to ensure the future prosperity of the entire province.

This is not to say that there is no opportunity for the municipality to obtain additional revenues either now or in the future.

- The municipality's non-residential tax rates are the lowest of major centres in the province. (Source: Applications Management Consulting Ltd.) It also maintains the same non-residential tax rate for both the rural and the urban service areas.
- The municipality does not implement by-laws authorizing supplementary assessments and tax levies to collect revenues from facilities completed or

¹³ Municipal Affairs is currently working with the RMWB and RIWG on a Municipal Fiscal Impact Model designed, inter alia, to forecast future revenue streams as a means of quantifying the extent of the municipality's ability to pay for needed infrastructure. However, this study was not completed within the Coordinator's study period.

operational part way through a year, which could be a significant untapped revenue source. (Source: Alberta Municipal Affairs)

- The municipality has adopted tax strategies that may be seen as somewhat unusual under circumstances of financial stress.
 - By 2008, the municipality hopes to have the lowest tax burden in its urban service area for residential properties compared to other centres in Alberta over 35,000 in population.¹⁴
 - By the same date, the municipality hopes to have the lowest total tax burden for all commercial properties compared to other municipalities over 35,000.
- For some time, the municipal charges for utilities, particularly for sewer and solid waste in the urban area, were significantly below full cost recovery. The municipality has now moved to become self sustaining for all utilities, within five years for the urban area and within seven years for the rural area. This is practical timing, although it can be argued that the municipality could be more aggressive in implementing its new policy.

At the same time, we are not aware of any definitive studies that show the effects of changes in these policies on the total revenue needs of the municipality. Intuitively, it can be concluded that significant changes in these policies could positively affect the amount of revenue shortfalls facing the municipality, but it is unlikely that they would, by themselves, resolve the revenue deficiencies.

5. Fort McMurray is unique.

It is clearly evident that infrastructure in Fort McMurray is under pressure as a result of rapid and sustained economic and population growth. But is Fort McMurray unique in Alberta? Should the community be considered for special funding to support infrastructure development?

In our opinion, Fort McMurray is unique for the following reasons:

- **Little capacity within the region to absorb growth**

Fort McMurray is a relatively isolated community with no major centres within a reasonable driving distance. This means that there is very little capacity outside of the community to absorb excessive growth. The economic and population growth and its impact on infrastructure must be absorbed by a single community. This is unlike other centres such as Red Deer, Lethbridge and Grande Prairie which have a number of satellite communities within a reasonable commuting distance that have the potential of providing supportive infrastructure such as housing, hotel accommodation, recreational facilities, etc.

- **Extreme rate of population growth over a sustained period**

The high rate of sustained population growth of Fort McMurray is unique. The community's growth rate over the last ten years has been almost double the rate of Alberta's second fastest growing community, Grande Prairie and is four times the

¹⁴ See the Edmonton Journal, December 17, 2006 "Oilsands income funds tax cuts: Wood Buffalo ups spending, drops property taxes".

average growth rate for Alberta. Population forecasts indicate that the rapid population growth in Fort McMurray will continue for at least the next five years.

- **Massive scale of industrial development**

Each oil sands project requires a massive capital outlay requiring a large construction and operations workforce. The region is one of the largest industrial sites in the world and the major projects which are developing concurrently require a significant amount of infrastructure and services to support them.

- **Small community and infrastructure base**

The cities of Calgary and Edmonton have a substantial infrastructure base to draw from and could absorb a major development project within their region. However, Fort McMurray is a relatively small community with a limited infrastructure base. A major project in the Fort McMurray area will have a significant impact and may result in a demand that surpasses the community's capacity to provide infrastructure and services. Several major projects proceeding together will certainly exceed the community's capacity to support them.

- **Province of Alberta holds land surrounding the community**

The Province of Alberta holds all of the land surrounding Fort McMurray. Annexation, resale and the rate at which the land is released are not controlled by the community. Also, urban centres in other parts of Alberta have the potential to share in the costs and revenues from land sold by the neighbouring county or municipal district for commercial or industrial development. These cost and revenue sharing agreements may help offset the cost of infrastructure provided by the urban centre to support the workers in rural development areas. For example, the County of Wetaskiwin, Town of Millet, and City of Wetaskiwin have formally adopted a cost and revenue sharing agreement. The agreement specifically focuses on planning and development, sharing of tax, and the sharing of costs associated with development.

- **Timing of revenues**

The community does not collect taxes on the oil sands projects until they are brought into production. These massive projects may take three or more years to complete. The community of Fort McMurray must provide the services and infrastructure, through existing budgets, until revenue can be collected after the project is completed.

Is Peace River or Cold Lake Unique?

The Peace River and Cold Lake areas are also part of Alberta's oil sands developments, and while these regions are growing, they have not shown the historic growth of the Fort McMurray region and forecasts indicate that both economic and population growth will not be as high, particularly within the study's five year timeframe. Unlike Fort McMurray, they have not been under extreme growth pressures for a sustained period of time and their population growth is not significantly above the provincial average.

Oil sands projects located in the Peace River and Cold Lake regions are all in situ projects which require less manpower for construction and operation than the oil sands mining projects which are located in the Fort McMurray region.

Peace River and Cold Lake have neighbouring communities that could provide some support for infrastructure if excessive population growth occurs. However, given the small community infrastructure base, the ability to supply needed infrastructure and services may be at risk if several in situ projects proceed together.

6. The provincial government has special obligations.

One of the larger and more important gaps identified in the previous section lies in municipal infrastructure, and it is where additional financial assistance from the provincial government will be required in the short and medium term. It can be argued that there is a hierarchy of services for which the provincial government has special responsibility, and that such a hierarchy might look something like this¹⁵:

- Shelter
 - Land for housing
 - Housing
- Health
 - Water and wastewater treatment, landfills
 - Health care
- Education
- Policing
- Roads
- Social Services
- Recreation

Clearly, the province can choose to deliver these services directly, through its public agencies or through the municipality, and the choice of how these services are to be delivered may vary from municipality to municipality according to different conditions facing each municipality. For example, for most of the province, the province assumes responsibility for provincial or regional roadways because they are beyond the ability of a single municipality to fund. On the other hand, residents of most municipalities would likely expect the lowest priority, recreation, to be delivered in large part by the municipality itself.

In this hierarchy, the top two priorities – housing and health services – are the two areas showing the largest gaps. And it is in these two areas where the municipality is least likely to have the financial ability to provide these services all by itself. In the case of the shelter priority for Fort McMurray, the nature of the surrounding landscape – lands owned by the province and difficult to develop – provides additional challenges for the Regional Municipality of Wood Buffalo. In addition, the cash flow issues facing the municipality create even more challenges.

¹⁵ Obviously, the exact placement of each category of services in the hierarchy is a topic for vigorous debate.

In the case of health services, the province has traditionally assumed responsibility for health care. However, for basic services supporting good health, like clean water, safe treatment and disposal of waste, the municipality has traditionally been expected to provide the infrastructure and the service. Unfortunately, the Regional Municipality of Wood Buffalo lacks the financial capacity to do it all in the short term and still provide some of the other services expected of a municipality in Alberta (such as municipal roadways and recreation).

In our view, given the peculiar circumstances of the Athabasca oil sands area and its importance to the province as a whole, the provincial government has a special obligation to provide additional financial assistance of a bridging nature for servicing land for housing and for the safe supply of water, wastewater treatment and landfills in the Regional Municipality of Wood Buffalo. It also needs to continue to assume its traditional role in the provision of education, health care, policing, and provincial or primary roads.

7. Future oil prices will sustain growth in the oil sands.

Long-term forecasting of world oil prices is fraught with uncertainty. On the demand side, global oil consumption is expected to continue to grow at 1.5 percent per year. On the supply side, production is expected to continue at a rate sufficient to meet world oil requirements. However, crude oil production in a number of countries is maturing, making increases in output more difficult and costly to achieve. As well, political instability in some key oil-producing regions of the world will likely deter investment, resulting in slower growth in output than otherwise would occur.

We expect oil prices to soften slightly from the 2006 levels to around \$55 US per barrel based on West Texas Intermediate (WTI) during the 2006 to 2011 period. Prices at these levels are sufficient to sustain long-term growth in oil sands development. Oil sands development decisions are very long-term decisions and not impacted by short-term price fluctuations.

8. Population in the oil sands areas will grow at different rates, with the greatest growth in the Athabasca oil sands area.

Population growth in the Fort McMurray urban service area is expected to continue to exceed growth rates anywhere else in Alberta by a wide margin. An eight percent per year increase in population is expected during the 2006 to 2011 period. Population increases in the Cold Lake – Bonnyville and Peace River regions will be moderate and are not expected to exceed the provincial average population growth rate of 1.8 percent per year during the next five years. A substantial labour requirement in the Industrial Heartland is expected over the next five to seven years. The large urban population in close proximity to the Industrial Heartland places the region in a better position to absorb the population increase than is the case in smaller centers, particularly Fort McMurray. The pace of oil sands development should be carefully monitored in all regions to ensure that proactive planning takes place.

9. Investment in the future of the oil sands is crucial for the continued prosperity of the province.

With the maturing of the Western Canadian Sedimentary Basin, conventional oil production is declining. As well, conventional natural gas production is expected to decline during the period 2006 to 2015. Coal bed methane production is expected to only partially offset the decline in conventional output. Investment in oil sands facilities is expected to be around \$50 billion during the 2006 to 2011 period. Oil sands development will contribute substantially to Alberta's and Canada's GDP over the next two decades. As well, oil sands development will partially offset the decline in provincial revenue from royalties which result from declining conventional sources of oil and gas.

10. Investment requirements include additional resources in some provincial government departments.

Staffing

A review of current and potential future resource needs was conducted. There is a serious gap in capacity for current Ministry staff to review existing environmental impact assessments (EIAs), identify and address potential environmental and social impacts, and follow up on actual impacts associated with these proposals. In view of the increase in development, this gap will only continue to widen. The gap is most serious in Alberta Environment and Sustainable Resource Development, although there is also a need for resources in Health and Wellness to review and follow up on these environmental assessments.

In addition to resources for EIA reviews, Alberta Environment and Alberta Sustainable Resource Development have identified a serious need for resources to address the potential environmental impacts associated with oil sands development including implementation of Cumulative Effects Management Association recommendations, watershed planning, integrated land use planning, review of Regional Sustainable Development Strategy, climate change, reclamation issues, standards setting, enforcement, and the review of new technology. Alberta Environment is proposing a 10 FTE office expansion in Fort McMurray to meet these demands, while Sustainable Resource Development expects a similar need for increase in resource requirements.

Grant funding

Numerous Ministries are involved in providing grants to municipalities. Infrastructure and Transportation, Municipal Affairs, and Alberta Seniors and Community Supports have provided the largest grant funding for the oil sands areas. Municipal Affairs funding has increased substantially in the Fort McMurray area from around \$4.5 million (2003-2006) to around \$8 million (2006-07). Grants for Cold Lake and Peace River areas have not seen the same rate of increase, likely a reflection of both the lower rate of growth and the smaller municipal infrastructure gap than in the Fort McMurray area.

Grant funding from Infrastructure and Transportation has also increased substantially in Fort McMurray from \$30 million (2003-2006) to a projected \$72 million (2007-2010). There is also an increase in grants to the Cold Lake – Bonnyville region. Grants to the

Peace River region show a slight decline from what was paid in 2004-2006 and what is projected to be paid from 2007-2010.

Since 2002, \$50 million in grants has been provided by Alberta Seniors and Community Support for provincially-owned housing, rent supplements, capital grants in support of new housing units, and land for new housing.

Growth indicators suggest that there will be a need for additional provincial government funding between now and 2012.

This is in addition to:

- \$16 million over two years for a province-wide pilot project on prevention of homelessness
- \$23 million province-wide for the annual cost of operating emergency shelters
- \$3 million province-wide for priority projects for homeless people.

Recommendations

Based on the projections for growth and our assessment of current and anticipated gaps in essential services, a comprehensive package of recommendations has been prepared. The recommendations fall into five categories:

- Over-arching recommendations focused primarily on the need for better planning, distinct approaches for high growth areas, and addressing environmental concerns
- Addressing gaps in the Regional Municipality of Wood Buffalo/Fort McMurray region
- Addressing gaps in Cold Lake – Bonnyville and Peace River regions
- Addressing the urgent need to plan for developments in the Industrial Heartland
- Taking the next steps

In addition, a number of outstanding policy issues are identified for further consideration by the provincial government.

Part 1: Over-arching Recommendations

ISSUE 1: Alberta's future prosperity is closely tied to the wise development of its oil sands resources. Investments by the provincial government in infrastructure to support the continued growth and development of Alberta's oil sands will provide a substantial return to the provincial government and the provincial economy through increased revenues from taxes and royalties.

RECOMMENDATION 1: The Alberta Government should place a high priority on the development of infrastructure necessary to support continued growth and development of the province's oil sands resource. The returns from this investment can then be used to address future needs in Alberta.

ISSUE 2: There is a need to maximize the return from the province's bitumen resource through enhanced oil recovery and upgrading into higher value-added products such as synthetic crude oil, gasoline, diesel and petrochemical products. Capturing the full value of this non-renewable resource will significantly increase economic activity and future revenue for the benefit of all Albertans.

RECOMMENDATION 2: The Alberta Government should develop policies and encourage research to promote enhanced oil recovery and increased value-added opportunities for its bitumen resource.

ISSUE 3: The established funding formulae and other processes for the allocation of resources do not work well for funding very high growth areas (areas which have been or are expected to grow at rates in excess of over six percent over an extended period of time), especially those high growth areas that are relatively isolated. Where existing formulae and processes are tied to equal access to funding for all geographic areas, the results may not always be compatible with good business decisions.

RECOMMENDATION 3: Provincial priorities should be set in a way that supports investments necessary to achieve future revenues and meet the business needs of the Province.

ISSUE 4: In times of high growth, environmental issues are sometimes overlooked.

RECOMMENDATION 4: Sustainable development should be considered a business need of the Province.¹⁶

ISSUE 5: The provincial government's planning system, as it relates to high growth areas, is inadequate.

RECOMMENDATION 5: Provincial government business planning for high growth areas should be separated from the regular government planning process. Additionally, there is a need:

- For planning to have a longer-term focus. The current three-year business planning process does not provide a sufficient time frame to address issues in high growth areas
- To ensure a coordinated decision-making process that considers all priority needs at the same time
- For one common population forecasting model, including demographics, designed to address planning needs in health, education, infrastructure, and other requirements. The results should be shared with municipalities, public agencies and the private sector
- To develop a set of reliable benchmark indicators for regional comparisons
- To develop one common data set where possible
- For government to involve municipalities, agencies and industry in the planning process. Industry needs to provide information regarding their development plans and the timing of development. In this regard, the RIWG approach is a positive approach to providing industry information in a coordinated fashion and should be encouraged in the other oil sands regions

ISSUE 6: High growth areas require specific attention during the budget process to ensure that their needs are addressed on a priority basis and in a comprehensive, integrated manner. Funding to address infrastructure and sustainable development issues in high growth areas must be a priority. And longer-term budget commitments are required for areas experiencing rapid and sustained growth.

Comparing the population of the Regional Municipality of Wood Buffalo to the population of Alberta indicates that for every one dollar per capita "taken off the top" of the Alberta budget and dedicated to the RMWB, it would reduce the per capita allotment to other Albertans by 2.43 cents, a small price to pay for future prosperity.

RECOMMENDATION 6: The resource allocation process for high growth areas should be separated from the regular government budgeting system.

¹⁶ Alberta defines "sustainable development" in the following way: *Alberta, a member of the global community, is a leader in sustainable developing, ensuring a healthy environment, a healthy economy, and a high quality of life in the present and future.* See "Alberta's Commitment to Sustainable Resource and Environmental Management", issued in March, 1999. The oil sands multi-stakeholder consultation defines sustainable development for the oil sands as "economic development that maintains the integrity of ecological and social systems upon which communities and societies are dependent."

ISSUE 7: Management and coordination of infrastructure and services to support oil sands development would be improved by establishing an ongoing process for facilitating Cabinet-level review and decision making.

RECOMMENDATION 7(a): The role and mandate of the Oil Sands Ministerial Strategy Committee (Cabinet Committee) should be expanded to include:

- Management and direction of the provincial delivery of infrastructure and services to the Regional Municipality of Wood Buffalo
- Coordination of provincial, municipal and industry responsibilities for the planning, financing and delivery of infrastructure in the Industrial Heartland
- Monitoring other potential high growth regions
- Identification and resolution of any policy gaps and inconsistencies impacting oil sands development

RECOMMENDATION 7(b): The Chair should be a member of the Agenda and Priorities Committee of Cabinet and Treasury Board.

RECOMMENDATION 7(c): The Committee should be supported by a small Oil Sands Sustainable Development Secretariat (four to five people) headed by a Deputy Minister level appointment.

ISSUE 8: Extra retention allowances and benefits are offered to provincial government employees working in Fort McMurray. However, these allowances and benefits are not consistent between the provincial government and public sector agencies including the Northern Lights Health Authority, the public and separate school boards, and Keyano College. This issue is also impacting the RCMP. These inconsistencies are hurting morale and putting increased pressure on agencies to fund retention allowances and benefits out of existing budgets. Improved coordination between the province and its agencies is needed.

RECOMMENDATION 8: Attraction and retention allowances and benefits for government employees and its agencies need to be consistent. The Alberta Government should increase funding to public sector agencies to address this issue.

ISSUE 9: Industry has, over the years, made a large contribution to the community of Fort McMurray. Recently, it has been suggested that industry, especially new oil sands developers, needs to make a larger contribution to the community, either through a surcharge applied to the sale of leases, by an increase in royalty rates, or by government dedication of a certain portion of royalty returns and lease sales to infrastructure development in the affected communities. On the other hand, it can be argued that it is the government's responsibility (provincial and municipal) to both provide major public infrastructure and to ensure that it has sufficient revenues to do so. Under this train of thought, mandatory contributions would not be established; it would be government's responsibility to decide how it obtained the necessary revenues to ensure the development of the necessary infrastructure.

RECOMMENDATION 9: Industry should be expected to continue its policy of contributing to the community in substantial ways. New companies seeking approval for new projects should be advised of this expectation.

ISSUE 10: Departments lack capacity to complete Environmental Impact Assessments (EIA's), to complete technical studies such as those involving instream flows, to focus on cumulative effects and to develop policy in a timely fashion. In addition, capacity to monitor and enforce environmental requirements is inadequate. One effect of this lack of resources will be the eventual inability on the part of the Province to deal with new applications for oil sands development in a timely way, and thus cause a delay in oil sands development itself. Another impact will be inadequate attention to cumulative effects and other issues raised by oil sands development.

RECOMMENDATION 10: A substantial increase in manpower (FTE's) should be provided to Alberta Environment and Alberta Sustainable Resource Development to focus on cumulative effects, EIA's, research, policy development, monitoring and enforcement in the oil sands areas. Some new resources should also go to Alberta Health and Wellness to support the EIA process.

ISSUE 11: Alberta Environment has not been able to provide timely advice and direction to industry relative to water use.

- Alberta Environment, tasked with “backstopping” the inability of the Cumulative Effects Management Association to obtain consensus on instream flow needs by December 31, 2005, has not yet formally released the July 10, 2006 draft of the Water Management Framework document entitled: *Instream Flow Needs and Water Management System for the Lower Athabasca River*, despite its discussion at a number of AEUB hearings. This document needs to be the subject of further consultation and then finalized before industry can collectively submit a plan for meeting the requirements of the framework by January 2007. Given the lack of a formal process to revise and complete the draft, it appears that this deadline will not be met.
- The development of an Instream Flow Needs (IFN) policy is of tremendous importance to the development of the oil sands area. Clear direction should be provided to the industry because “[c]urrently accepted IFN methods, which incorporate science and professional judgment, indicate a more restrictive withdrawal regime may be required to achieve protection of the River in Phase 2 with greater water withdrawals.”
- Little work has been done by the department to advise and direct industry (upgraders and other plants) who are planning to locate in the Industrial Heartland, about the availability of groundwater or withdrawals from the North Saskatchewan River.

RECOMMENDATION 11(a): The July 10, 2006 draft of the Instream Flow Needs policy should be released officially and every effort should be made to complete, publish and enforce a water management scheme that will protect the ecological integrity of the aquatic ecosystem of the lower Athabasca River, to be implemented on a phased-basis beginning no later than July 1, 2007.

RECOMMENDATION 11(b): Alberta Environment should assign urgent priority to defining the water supply (both surface and groundwater) available for use in the Industrial Heartland area.

ISSUE 12: The Cumulative Effects Management Association could be more effective in addressing environmental issues around oil sands development. Although consensus based decision making processes, such as those used by CEMA, can contribute to better decisions, they can also delay important decisions when parties cannot agree.

RECOMMENDATION 12: The provincial government should initiate an independent evaluation of the operations of the Cumulative Effects Management Association with a view to enhancing its efficiency and timeliness in developing recommendations. The review should address governance issues, types of decisions which need not be the subject of consensus, the adequacy of the regulatory backstop, and the resources required for CEMA to be more effective.

ISSUE 13: The decision-making context within which decisions are being made in the oil sands areas are unclear, outdated or incomplete. There are a large number of complex policy exercises underway which bear on development in the oil sands.

RECOMMENDATION 13: Priority should be assigned to completing current initiatives related to land use and cumulative effects planning, such as the Land Use Framework, the Integrated Land Management Program, the updating of the Regional Sustainable Development Strategy and associated regional planning tools, as well as the completion of the vision and strategies for oil sands development. Discussions concerning the requirements for reclamation should be concluded and policies clarified in a timely manner.

ISSUE 14: Air emissions in the oil sands need to be addressed, including the production of greenhouse gases (GHGs). Industry has been making progress in the reduction of GHGs per barrel of bitumen produced, but the total production of GHGs increases as total production rises.

RECOMMENDATION 14(a): The Alberta government should continue to support projects related to carbon dioxide capture, transport and storage and in the use of carbon dioxide to enhance conventional oil recovery rates.

RECOMMENDATION 14(b): The Alberta government should develop a policy framework related to managing CO₂ emissions from oil sands projects as part of an overall initiative to address CO₂ emissions and enhanced oil recovery.

ISSUE 15: Time has not permitted a full examination of issues involved in development of Crown Consultation Guidelines now being negotiated with the First Nations of the Athabasca Tribal Council (ATC). However, as a result of discussions with Alberta Aboriginal and Northern Development (AAND), it appears that good progress is being made in the development of guidelines specific to the oil sands region. A consultation committee (the Protocol Working Group) representing Environment, Energy, Sustainable Resource Development, Community Development and AAND, as well as the five ATC First Nations, has been formed, a terms of reference adopted, and a process to define the roles, work plans and jurisdictions of the parties has been completed. Bilateral

meetings with First Nations are ongoing, with the parties at the point of collaborative drafting of guidelines.

In terms of negotiations underway to develop a long-term benefits agreement (which would include the development of Crown consultation processes and the continuation of existing stakeholder consultations between industry and the Athabasca Tribal Council), an agreement in principle has been reached (April, 2004) which was approved by Agenda and Priorities Committee of Cabinet. Conclusion of the final, formal agreement remains subject to ongoing negotiations on the size of the trust fund to be established to provide First Nations with compensation for irreparable impacts of development on their aboriginal and treaty rights as part of the agreement.

While the legal obligations of the Crown to develop a formal consultation process with Métis in the oil sands area are unsettled in Alberta, industry has been involved in both short term assertion agreements and long-range consultation agreements with Wood Buffalo Métis Organizations.

Negotiations involving Canada, Alberta, the Fort McKay First Nation and Shell Canada Limited are underway to use Alberta's regulatory regime to regulate Shell's mining of 8,000 acres of surface mineable oil sands on Fort McKay Reserve lands. These negotiations were made possible by the passage of the federal First Nations Commercial and Industrial Development Act. Good progress has been made, and it is hoped that agreement will be reached on necessary documents by some time in 2007.

RECOMMENDATION 15: The provincial government should continue to support negotiations currently underway in an effort to provide certainty in the business environment surrounding the development of the oil sands in the Athabasca Oil Sands Region, to enhance the ability of First Nations and Métis to participate in the benefits of development, and to ensure fairness for all parties involved in that development.

ISSUE 16: Several proposed new oil sands projects are located a substantial distance north of Fort McMurray. This requires lengthy commute times or the development of permanent camps to house operational staff. A new town has been identified by oil sands operators as an option to house employees. On the surface, this concept would appear to be a very impractical and expensive option.

RECOMMENDATION 16: The Alberta Government, in conjunction with the Regional Municipality of Wood Buffalo and industry, should undertake a feasibility study to determine the need for and the costs associated with development of a new town north of Fort McMurray.

Part 2 – Addressing Gaps in the Regional Municipality of Wood Buffalo/Fort McMurray Area

ISSUE 17: Sufficient land has been identified to meet housing requirements to 2011 and well beyond. The current issue is not about the province's ability to release new lands in a timely fashion. The issue is about how quickly planning can be completed to enable

that land to be sold and developed so that new housing can be built as quickly as possible.

There has been criticism in the past about the slowness of the province to release land for housing. However, the delay in increasing the amount of land for housing is now the result of delays in the municipal planning and approval processes. For example, the area structure plan for the Saline Creek Plateau has yet to be completed and a number of issues such as the Rotary Club lease, which could provide additional land for housing, have not been resolved within the municipality.

RECOMMENDATION 17(a): The capacity to undertake municipal planning processes must be enhanced. Any inability of the municipality to make timely planning decisions will further delay the development of sufficient housing stock to meet population growth. The province needs to assist the Regional Municipality of Wood Buffalo to put sufficient experienced planning resources in place to increase the capacity to complete area structure plans in a timely manner.

RECOMMENDATION 17(b): If the area structure plan for Saline Creek is not completed in a timely manner, the province may wish to consider other options to speed up its completion. Effective, but somewhat unpalatable, options could include establishing deadlines, taking over the planning process itself and exempting the land from municipal approval requirements pursuant to section 618(4) of the Municipal Government Act. Alternatively, the province may choose to use its regulation-making authority under Section 694(5) of the Municipal Government Act to direct the municipality to take certain actions.

RECOMMENDATION 17(c): The province needs to ensure that provincially-owned land is released in a timely fashion to meet housing needs well in advance of actual requirements. In this regard, the Draft Land Release Strategy needs to be updated by the province and approved.

RECOMMENDATION 17(d): To ensure timely development, the province needs to continue the practice of placing conditions regarding the pace of development on land sold by the province.

RECOMMENDATION 17(e): The Regional Municipality of Wood Buffalo should complete area structure plans well in advance of the need for development. The municipality also needs to ensure timely issuance of permit approvals.

RECOMMENDATION 17(f): The municipality is faced with the need to provide up front investment for offsite infrastructure for the development of the Saline Creek area. Detailed estimates are not available; however, this could amount to \$125 million, or more. The province should provide the municipality with a means of bridging the up front costs until they are recovered from developers. In the case of the Saline Creek area, the provincial government should pay for the offsite servicing costs and recoup the funds as developers pay offsite levies to the municipality. This option would be open only to the Regional Municipality of Wood Buffalo as a high growth area. (The concept was previously employed under the now defunct Alberta Home Mortgage Corporation.)

ISSUE 18: Existing federal-provincial affordable housing programs appear to be adequate to meet affordable housing needs in Peace River and Cold Lake – Bonnyville. However, existing programs are not capable of meeting the affordable housing needs in Fort McMurray. A significant injection of capital is required to fund affordable housing in Fort McMurray during the 2006 – 2011 time period. None is budgeted at the present time.

RECOMMENDATION 18(a): For the 2007-08 and 2008-09 fiscal years a total of \$45 million per year should be allocated to provide 600 affordable housing units in Parcels D and F.

RECOMMENDATION 18(b): Timely decisions about the extent of affordable housing in Saline Creek, Willow Square and other areas need to be made and budgeted for following an evaluation of the effect of the provision of the 600 units in parcels D & F.

RECOMMENDATION 18(c): Alberta Infrastructure and Transportation needs to include provisions for land for affordable housing when the province sells the land in Saline Creek and other areas in the future.

ISSUE 19: There is a need to enhance the existing WBHDC partnership with essential service employers until such time as sufficient affordable housing comes on stream to meet the needs of newly arrived essential service workers in Fort McMurray.

RECOMMENDATION 19: Because of the importance of attracting new employees in the health, education and policing areas, a one year rent subsidy should be offered for those essential service employees who qualify for affordable housing. A budget of \$1 million per year for three years is required, with priority to be based on lowest disposable income.

ISSUE 20: As a result of rapid population growth over a seven year period, all major infrastructure systems in Fort McMurray need significant expansions. The water treatment plant, the waste water treatment plant and the solid waste facility are currently at or over their designed capacity and need major expansions immediately. These facilities will need funding over the next five years that will likely exceed \$300 million.

The municipality is expecting a total of \$50 million in grant funding to assist with basic infrastructure needs over this period. As well, a \$136 million loan (interest free for four years) has been committed by the province to assist with the construction for the waste water treatment facility. However, this still leaves a funding requirement of \$115 million for needed municipal infrastructure.

Although there are a number of opportunities for the Regional Municipality of Wood Buffalo to increase its tax revenue, the ability of the municipality to fund these infrastructure projects over the next five years is highly questionable. Existing funding approaches are not adequately addressing infrastructure needs in an appropriate and timely manner. It may be unreasonable in any event to expect the municipality to fund the full cost of basic municipal infrastructure required to support the massive oil sands projects which benefit the entire province.

In addition, Fort McMurray's master plans are no longer relevant and are in urgent need of updating. The municipality must immediately develop new master plans for transit, recreation, utilities, transportation and municipal infrastructure to help keep short-term remediation activities in line with long-term planning.

RECOMMENDATION 20(a): The Government of Alberta should provide expertise and resources to the Regional Municipality of Wood Buffalo to ensure timely completion of master plans needed to do proper long-term municipal planning.

RECOMMENDATION 20(b): The Government of Alberta should provide direct funding to the Regional Municipality of Wood Buffalo for basic municipal infrastructure through mechanisms such as conditional grants or loans which would require full or partial repayment (depending upon the extent of future municipal tax revenues) if and when potential municipal tax revenues materialize. Criteria should be developed to determine the circumstances in which these loans or grants would be forgiven or repaid. The criteria should be linked to the municipality's future repayment ability and should be conditional on the demonstration by the municipality that their tax policies and bylaws were appropriate, based on the circumstances facing the municipality.

ISSUE 21: The quantity and quality of health services available to residents of the Regional Municipality of Wood Buffalo are significantly below what can be called a reasonable expectation of residents in other regions of the province, according to most benchmarks. Satisfaction surveys show Northern Lights Health Region residents have the lowest satisfaction levels in the Province.

The unacceptable level of health service in the health region is in part because:

- Funding formulae for health care do not provide adequate funds to meet the needs of a high growth area such as Fort McMurray.
- The need for new health facilities is not adequately recognized in either municipal or provincial planning processes.
- Alberta Health and Wellness and the Northern Lights Health Region need to agree on an appropriate vision for health care services in the region.
- Issues related to the attraction and retention of staff in the region have an especially large impact on the provision of health services.

RECOMMENDATION 21(a): Alberta Health and Wellness should become more directly involved in working with the Northern Lights Health Region to develop a vision and plan for medical services in the region that meet the needs of the residents.

RECOMMENDATION 21(b): A significant infusion of resources, both operating and capital, is required to avoid further deterioration and possible collapse of the system as growth continues in the area. A number of steps should be taken now to improve health care delivery in the short term, pending completion of a longer term vision and plan:

- Development and funding (capital and operating) of a continuing care and supportive living facility located outside the hospital which will free up space in the existing hospital for active care treatment.
- Creation and funding of adequate isolation rooms to deal with possible pandemics.
- Priority attention needs to be directed to the attraction and retention of health care workers in the Northern Lights Health Region. The provincial government should design and fund temporary salary and wage market modifiers for a three- to five-year trial period that would provide additional compensation to physicians, nurses and other specialized health care workers who are willing to locate in Fort McMurray.
- Immediate funding outside the current funding formula should be established to bring the standard of health care service in Northern Lights Health Region to acceptable levels. The requirement for a recovery (deficit elimination) plan to address the current deficit should be suspended until acceptable service levels are reached.
- Alberta Health and Wellness and Northern Lights Health Region need to engage in a process to reconcile health care registration numbers with municipal census data on an annual basis and adjust base funding for the region accordingly.
- Area structure plans should reserve land for future medical sites in accordance with the agreed upon vision.
- Immediate funding should be allocated to build a parkade at the current hospital site. Access for helicopter cases (medivac) would be improved by a heli-pad on top of the parkade.
- Given the high turnover of senior staff and the complex process for obtaining capital approvals, ways should be found to expedite relatively simple capital requests, such as the parkade and the interim ambulatory care re-development program.

ISSUE 22: Performance indicators for all three oil sands regions, including the Athabasca oil sands area, show that the provision of education services is generally satisfactory and comparable to provincial averages. The one exception is Northland School Division which is substantially below provincial standards with respect to some key indicators (e.g. completion of high school in three years).

- While most school facilities are operating at full capacity, capital planning for immediate future requirements appears to be adequate including funding of three

new schools and some major modernizations and portables for the urban service area.

- New housing coming on stream will mean increased growth in enrolment during the next five years which will require capital and operating resources to address.

RECOMMENDATION 22(a): The province should ensure that the school boards' future planning and Alberta Education's vision as outlined in *Schools for Tomorrow* are coordinated.

RECOMMENDATION 22(b): Operating and capital funding should be provided by the province to meet the projected future growth of student enrolments, which may come quickly from the increased availability of housing.

ISSUE 23: The 2005 RIWG reports significantly underestimate the cost for transportation infrastructure.

- Total government commitments to date have exceeded the RIWG requests in dollar value. However, of the transportation projects committed by the government, a substantial portion remains unfunded.
- Some improvements within the urban service area, including four major interchanges, and the twinning of Highway 63 are not yet fully funded.
- Industry believes there has been a commitment by the provincial government to fund 25 percent of the East Athabasca Corridor Road. However, a written commitment has not been located.
- There has been little discussion about the coordination of public and private airports in the region.

RECOMMENDATION 23(a): Alberta Infrastructure and Transportation should establish as its priority the required transportation improvement projects north of the Highway 63 and 881 intersection.

RECOMMENDATION 23(b): Until such time as Highway 63 south of the 881 intersection can be twinned, passing lanes and staging areas need to be developed to increase safety on this section of highway.

RECOMMENDATION 23(c): Alberta Infrastructure and Transportation should consider a longer timeframe for the twinning of Highway 63 south of the 881 intersection in favour of earlier work on the four major interchanges within the urban service area.

RECOMMENDATION 23(d): The \$150 million east Athabasca corridor road requested by RIWG should be considered an industrial road used principally for industry access to oil sands projects and therefore should be funded entirely by industry.

RECOMMENDATION 23(e): Alberta Infrastructure and Transportation should set target completion dates for major provincial highway projects within the Regional Municipality of Wood Buffalo to assist the municipality in coordinating their own municipal road projects.

RECOMMENDATION 23(f): An airport master plan should be developed for the Regional Municipality of Wood Buffalo to coordinate future development of private and public airports.

ISSUE 24: Homelessness and lack of affordable housing are serious social issues in Fort McMurray. The community is not seeking capital for new or additional shelters. However, additional funding for operating expenses and to provide additional capacity at Marshall House is required.

RECOMMENDATION 24(a): Alberta Seniors and Community Supports should provide funding for Marshall House's proposed operating expenses.

RECOMMENDATION 24(b): If the pilot project to help the homeless with the skills and services they need to become more independent and the transition to other housing options is successful, Alberta Seniors and Community Supports should consider ongoing support for the program as a way to address the homeless issue.

ISSUE 25: The lack of affordable, quality child care in Fort McMurray is impacting labour supply for both the service sector and the essential services sector.

RECOMMENDATION 25: The provincial government should work with the municipal government, community groups and industry to provide more affordable quality child care in the region. Consideration should be given to enhanced child care subsidies for low income families as a mechanism to promote affordable child care in high growth areas such as Fort McMurray.

ISSUE 26: The rapid rate of population growth, the prosperity gap between those working in the oil sands and those working in other areas, the lack of affordable housing coupled with the difficulty social agencies find in attracting and retaining staff, has all contributed to difficulties faced in delivery of family and social service programs in the Fort McMurray area.

RECOMMENDATION 26: Initiatives related to issues such as affordable housing, child care shortages, health care issues and workforce shortages should be continued with a view to reducing family stress and the accompanying need for support services.

ISSUE 27: Policing services in the Regional Municipality of Wood Buffalo are considered adequate, although some capital improvements remain to be dealt with and some staffing increases would be helpful.

- The municipality is in the process of constructing a new \$52 million RCMP headquarters in Fort McMurray to be opened in early 2008. This building will not include remand facilities.
- The existing downtown cell block needs to be replaced. A new remand centre has been proposed, at a cost of \$104 million; however, the provincial government has not yet assigned this facility a priority in the capital plan.

- Generally speaking, staffing levels meet the provincial average number of officers to population ratio. However, like other essential service providers in Fort McMurray, attracting and retaining personnel is a problem for the RCMP.
- A proposal to increase the pay grids for new recruits has been submitted to the Federal Treasury Board but it has not yet been approved
- Drug-related offences continue to be a serious issue in Fort McMurray.

RECOMMENDATION 27(a): The provincial government should continue to pressure the federal government to increase pay scales for RCMP officers in the Regional Municipality of Wood Buffalo as a means of improving recruitment and retention.

RECOMMENDATION 27(b): The provincial government should provide funding to support a province-wide program, with full time staff, to provide tactical teams that can deal specifically with drug problems in the Fort McMurray region and in other parts of the Province. The program should initially be available to Fort McMurray on a regular basis and should eventually result in a team or teams deployed in Fort McMurray.

RECOMMENDATION 27(c): The provincial government should commit funding to share the costs of construction of a combination storefront policing/cell block/remand centre in downtown Fort McMurray.

Part 3 – Addressing Gaps in Cold Lake – Bonnyville and Peace River Areas

ISSUE 28: The Cold Lake and Peace River oil sands areas will need to be monitored closely in the future. Announcements of major in-situ projects or upgraders in these regions could have a substantial impact on the ability of the region to provide the necessary infrastructure to support these developments.

In the Cold Lake and Peace River regions most of the tax revenue from oil sands development flows to the rural municipality in which the development is occurring. The rural municipality's responsibility for the provision of infrastructure is largely limited to the road network. However, urban centres such as the Town of Peace River, the Town of Bonnyville and the City of Cold Lake experience significant infrastructure demands, for which there is little new revenue outside of some additional residential taxation. The lack of cost and revenue sharing agreements is causing urban/rural tensions.

The Resource Road Program could be an important contributor to the development of the oil sands in the Cold Lake and Peace River regions. The program provides approximately \$17 million in cost shared grants to rural municipalities for upgrading local roads that are impacted by resource development. Eligible projects include construction or re-construction of local roads and bridges and improvements required to an intersection of a local road and a provincial highway. The province recently announced an increase of \$34 million in funding for the program in 2007-08. However, the program is expected to end in fiscal 2008-09.

RECOMMENDATION 28(a): The Oil Sands Ministerial Strategy Committee and the Oil Sands Sustainable Development Secretariat should be charged with careful monitoring of growth and growth trends in the Cold Lake – Bonnyville and Peace River areas. Should population forecasts indicate that levels of ‘high growth’ (at least six percent per year) will be sustained over at least three years, government planning and budgeting for these areas should be done in the same way as recommended for the Athabasca oil sands area.

RECOMMENDATION 28(b): The provincial government should deal with issues related to rural/urban revenue and cost sharing in the Cold Lake/Bonnyville and Peace River areas. As growth continues, these will become ever larger issues.

RECOMMENDATION 28(c): The provincial government should review the criteria and funding under the Resource Road Program to ensure it meets the needs of the Peace River and Cold Lake – Bonnyville regions. The province should also extend the program beyond its current 2008-09 end date.

Part 4 – Addressing Gaps in the Industrial Heartland

ISSUE 29: The industrial heartland will see approximately \$25 billion in investments, the bulk of which will occur over the next five years, for upgrading bitumen into synthetic crude oil. Construction of these upgraders is projected to increase the region’s labour force over the next five years to about 15,000-20,000 in 2011 with even higher peaks expected from 2012 to 2015. Development in this area is occurring much more quickly than previously anticipated and a transportation plan to accommodate the influx of labour is needed soon.

To date, Alberta Infrastructure and Transportation has not participated directly in planning the roadway system in the industrial heartland and has no money budgeted in its current three-year capital plan for financial support of extraordinary requirements for road construction. Industry complains that the Province is not sufficiently engaged.

RECOMMENDATION 29: Alberta Infrastructure and Transportation should immediately join with the respective municipalities and industry to develop a comprehensive transportation and utility plan for the Industrial Heartland, including identification of any needed funding. This needs to be done on an urgent basis.

Part 5 – Next Steps

ISSUE 30: As a result of the short timelines involved with this project, no attempt to develop a consensus on the recommendations has been made. Similarly, detailed costing of recommendations has not been possible.

RECOMMENDATION 30: To follow up on this report, a short-term action plan for sustainable development coordination should be developed and should include:

- Appointment of an Acting Oil Sands Sustainable Development Coordinator pending recruitment of a full-time coordinator
- Vetting of this report with departments, with affected municipalities and with industry
- Development of a more accurate costing of recommendations
- Review of these recommendations in the light of Premier Stelmach's pledge to provide additional annual funding to municipalities
- Development of a practical and fiscally responsible timing and phasing of the actions resulting from this report.
- Preparation of a Ministerial Request for decision on budgets and timing
- Approval by the Cabinet Committee and Cabinet

Part 6 – Costing of recommendations

Time did not permit a detailed costing of recommendations, and such a detailed costing will need to be done in the near future.

The majority of recommendations have operating cost implications, at least for the next five years. Only five of those have been costed (recommendations 7, 12, 16, 19 and 24), amounting to about \$8.9 million over five years. The others must be costed by the appropriate departments which have the necessary expertise and information to do so. The operating cost implications of the remaining recommendations may be significant.

Of the capital requirements, we have identified some \$790.7 million in projects which will require additional capital commitments¹⁷ for the Rural Municipality of Wood Buffalo, excluding any capital costs required for health services.¹⁸ Of that amount, some \$364.7 million will be subject either to cost sharing with the municipality (combination remand center, storefront policing center) or to recovery from the municipality depending on future revenues of the municipality. An additional \$92 million remains uncommitted after 2011, all of which may be recoverable. On an annual basis, these costs (excluding health care capital requirements) would be in the order of \$160 million per year, less "recoverables," which could be as high as \$75 million per year.

¹⁷ Provincial transportation projects involving the urban service area account for some \$336 million of this total.

¹⁸ The most significant capital costs are likely to occur near or after 2011. Municipal Affairs, in its strategic update submission, included some \$119.7 million.

Overall, the average annual additional commitment necessary for capital spending could be in the order of \$85 million, excluding capital funding for health services which cannot be determined until longer-term plans are developed in collaboration with Alberta Health and Wellness.

Part 7 – Outstanding policy issues

The difficulty the oil sands area has experienced in securing appropriate and timely services and infrastructure during periods of high growth is due in part to policy anomalies that may impact on the municipalities' ability or the province's ability to plan and pay for needed responses to growth pressures. Some of these anomalies are unique to the oil sands area; others are over-arching issues that apply across the province.

Most of these policy issues can be resolved in the next three to five years. Some may require changes to statutes or to regulation, and these will take some time to affect. Others may require a simple change to government policy or simple regulation change by Ministerial order or by Order-in-Council, and could be done reasonably quickly following the necessary study and review by Caucus, Standing Policy Committees and Cabinet. For example, a policy that declares that, "*the spending necessary to ensure the continued growth of government revenues from oil sands production in the future is a business decision necessitating required investment in some priority over other demands for government spending*" requires no legislative change. Such known policy positions can, by themselves, instill confidence in private sector investors and encourage those who provide services and infrastructure to ensure that the decisions they must make are timely and appropriate.

In the interests of avoiding any unintended adverse impact on the collective ability of the province and the municipality to respond to growth pressures, it is recommended that the Oil Sands Ministerial Strategy Committee review the following policy issues and consider changes that would encourage, rather than inhibit, a business-like approach to ensuring the future productivity of the oil sands.

Rural-urban cost and/or revenue sharing issues

New and rapid growth near urban centers has the potential to both inhibit the coordination of service and infrastructure development and to create considerable disharmony. This isn't an issue in the Regional Municipality of Wood Buffalo because the rural and urban jurisdictions have been amalgamated. But in the Cold Lake – Bonnyville area, most of the tax revenue from oil sands development is payable to the M. D. of Bonnyville whose responsibility for the provision of supporting infrastructure is largely limited to the road network. Yet the City of Cold Lake is experiencing significant infrastructure demands for which it has little new revenue outside of new residential taxation.

A similar situation exists on the northern boundary of the City of Edmonton. New upgraders being planned for the Industrial Heartland will pay property taxes to rural municipalities outside of Edmonton, yet Edmonton feels it will experience increased demands for roads, residential development, sewer and water, recreational facilities and

other amenities necessary to sustain a growing workforce that will, at least in part, be housed in Edmonton.

Other rural-urban tensions can be found across the province, including tensions between the town of Peace River and the Northern Sunrise County and the M.D.s of Smoky River and Big Lakes.

This is a long-standing issue and it has not always been resolved amicably between municipalities, although efforts continue.

In these situations, the provincial government may want to consider alternative ways to encourage faster, more definitive resolution of inter-municipal cost sharing and/or revenue sharing issues. The options range from a mandated level of cooperation, complete with mediation or arbitration, to the appointment of special coordinators with clear legal authority to compel a solution to the outstanding issues.

Federal government responsibility

For 2006, CERI estimates that total government revenues resulting from oil sands development will amount to over \$6.8 billion, of which nearly 43 percent will flow to the federal government. Only 25 percent of those revenues will flow to the provincial government. That relative share of revenues stays about the same to 2011. By 2020, it is estimated that the gap will begin to narrow to 38 percent to the federal government and 33 percent to the provincial government.

Nonetheless, the fact remains that the federal government receives more revenues from oil sands development than does the provincial government. Yet the principal responsibility for investing in oil sands infrastructure to ensure that return has rested on the provincial government and the municipalities.

In the Athabasca oil sands, for example, the federal government has been quick to involve itself in regulatory matters through the environment and fisheries jurisdictions, but it has not been nearly so quick to involve itself in contributing to the necessary infrastructure. The recent announcement that the federal government will provide \$150 million in funding to assist with the twinning of Highway 63 is a welcomed, but likely insufficient, change in federal policy, given the returns it receives on Alberta's investment.

In a submission to the AEUB during the Kearl hearing, the Regional Municipality of Wood Buffalo estimated that 12 percent of its capital budget came from provincial grants and one percent from federal grants. The municipality can expect about \$1.9 million from the federal government in support of public transit security and \$8.9 million as part of the federal government's "new deal" for municipalities. Phase 2 of the Canada-Alberta Affordable Housing Program commits at least \$63 million over two years (for the entire province). According to the August 24, 2006 Canada/Alberta press release \$31 million has been announced for 319 affordable housing units - again for the entire province. Given the municipality's identified needs of some \$800 million in infrastructure over the next few years, it is clear that the federal government could usefully play a larger funding role in this area.

The provincial government may wish to consider developing a comprehensive, concentrated approach to convince the federal government that they should accept a greater responsibility for ensuring that revenues to both jurisdictions continue to grow in the next five years.

Sources of revenue for municipalities

In 2006, the main sources of revenue for municipalities continue to be property taxes, which fall into four assessment classes: residential, non-residential, farm land, and machinery and equipment.

In the oil sands regions, a considerable and growing portion of the municipal assessment base is comprised of machinery and equipment assessment. Municipalities have a growing concern that the Municipal Government Act does not allow a municipality to assess and tax machinery and equipment until the facility has been completed or is in operation. For a municipality, this means that there is potentially a large amount of additional taxable income available in the long term but not in the short term. However, most of the municipal infrastructure to support industrial growth must be constructed before the completion of the industrial facility.

The Oil Sands Ministerial Strategy Committee may wish to review these provisions in the context of the additional revenues required by high growth areas such as Fort McMurray.

In addition, the Committee may wish to consider the following legislative and policy issues:

- **Section 291 of the Municipal Government Act** – This legislation prevents municipalities from assessing and taxing new plant construction until the facility is actually complete or in operation.
- **Assessment levels for machinery and equipment** – This regulation means that machinery and equipment assessment in a new plant must reflect 77 percent of its value.
- **Immediate Depreciation** – Schedule C of the Minister’s Guidelines requires that machinery and equipment in a newly-constructed facility be immediately assigned a depreciation of 25 percent.
- **Excluded costs** – As much as 15 to 25 percent of the cost of a facility is not included for assessment purposes, mainly due to exclusions for distance from urban sources of labour and materials.
- **Equal tax treatment of machinery and equipment within the same service area:** Under section 354 of the Municipal Government Act, a municipality may not establish different tax rates for machinery and equipment, non-residential and linear properties within the same urban service area. (In the case of Regional Municipality of Wood Buffalo, which is an amalgamated municipality, it could establish different rates between urban and rural service areas, but it has not chosen to do so.) However, all machinery and equipment, non-residential and linear properties within the urban service area of Fort McMurray would need to have the same tax rate, and all

machinery and equipment, non-residential and linear properties within the rural service area would need to have the same rate.

A number of resolutions have been adopted by the Alberta Urban Municipalities Association calling for the repeal of legislation establishing the 77 percent assessment level and the 25 percent depreciation requirement. A resolution has also been passed to abolish Section 354(3.1) of the Municipal Government Act.

The effect of these provisions means that only about 45 – 50 cents of every dollar of capital investment in oil sands projects is assessable. The Oil Sands Ministerial Strategy Committee may wish to review these provisions in the context of the additional revenues required by high growth areas such as Fort McMurray.

Issues around changing these provisions include a concern about inter-provincial competition for tax breaks and the need for equal treatment for all industries across the entire province. However, it should be noted that oil sands development is a unique industry not present in all parts of Alberta or in all provinces. This might be sufficient rationale to make changes to the legislation specific to the oil sands industry.

In addition, the Oil Sands Ministerial Strategy Committee may wish to consider other ways of supplementing municipal revenues, including:

- Dedicating a certain portion of lease and royalty payments received from oil sands projects to the municipality where development occurs to finance the infrastructure required by new growth. There is some support for this idea from some of the operators in certain areas. This may be a reasonable suggestion in those areas where the industry is reasonably mature; it might not work so well where there are long periods of time between when the infrastructure is required and when the plants actually start to pay royalties.
- Requiring, or at least encouraging the pre-payment of property taxes where section 291 of the Municipal Government Act prevents immediate access to a new tax base.
- Considering the future of education property tax. A number of municipal leaders have suggested government should pass back some or all of the education tax collected by the province. Note that the education tax on machinery and equipment was entirely eliminated when industries in the province invested over \$2 billion per year in specific target years.
- Reviewing the royalty structure. Such review would likely include questions around the level of taxation, the choice of whether or not royalties should be taken in kind, and election options. Presumably this review would also include consideration of how any change in royalty revenues might be distributed.

Cumulative effects on the environment

The current process for examining development proposals by industry involves the preparation of an Environmental Impact Assessment (EIA) and its submission to a hearing by the Alberta Energy and Utilities Board. As part of its consideration of the public interest, the AEUB examines both environmental and economic impacts of the proposed development. The AEUB also has authority to consider social issues.

The current process has been stressed to some extent by the rapid pace of development and questions have begun to surface about the effectiveness of the process insofar as it relates to cumulative effects. Some of these issues include:

- **Quality of analysis** – As the agency in charge of managing the EIA process, Alberta Environment has found itself under increasing pressure to ensure the delivery of a quality product in a timely manner. These two objectives are somewhat incompatible in the face of rapidly appearing new applications. In the past, Alberta Environment could expect four – five EIA's per year; currently the department has some 39 EIA's on its plate and without additional resources it seems likely that quality will suffer if the predominant objective is speed.

Similarly, the consultant community used by proponents to prepare EIA's and assist in the application process is under similar stresses.

The AEUB itself is likely facing similar pressures. There have been four major hearings on oil sands applications in the last six months which will require a great deal of analysis and thoughtful consideration before decisions can be rendered. Decisions are expected to be rendered in a timely manner. These hearings are in addition to other ongoing responsibilities of the AEUB not necessarily related to oil sands issues, which are also facing increasing pressure as a result of Alberta's rapidly growing economy.

- **Decision-making context** – The process of examining, one by one, applications involving significant development activities, and the complexities and impacts that go along with those activities, is seen to be effective in dealing with single or individual applications. However, the jury is still out on whether or not this process can be effective in measuring and dealing with cumulative effects of a large number of single or individual applications more or less at the same time.

There likely are a number of ways in which a better prediction of cumulative effects might be obtained, including some through the regulatory process. One suggestion has surfaced which would "batch" a number of applications so that the AEUB could consider all impacts of a number of applications within one hearing. While this may result in conflict between applications if not all proponents are ready to proceed at the same time, it is an option which deserves further study. Another option would see the government providing direction to the AEUB that would have it make decisions within an overall or regional plan which defines the maximum allowable environmental or economic impacts over a specified period of time.

- **Policy making** – While the AEUB's legislation allows it to consider and presumably make recommendations and/or decisions on social issues, concerns have been raised about the potential conflict between appointed officials tempted or attempting to make social policy decisions and those who have been elected to make those same social policy decisions. It may be useful for government to better define the line between such responsibilities.

Concluding comments

This report is intended to provide not only a solid base of information about current and anticipated needs and gaps in the three oil sands regions, but also to provide recommendations to the Oil Sands Ministerial Strategy Committee on actions the provincial government can and should take to address those needs over the next five years.

The findings of the report indicate that oil sands development is critical to Alberta's continued prosperity. Forecasts suggest that investments in oil sands projects will continue, resulting in a substantial increase in production over the next five years as well as continuing high rates of population growth, particularly in the Athabasca oil sands region.

Given that forecast, it will be even more important for the provincial government to address current and anticipated gaps in essential services and supports, particularly around housing, basic infrastructure, health care, and transportation. A comprehensive approach to planning for the oil sands regions is required to address pressing needs in the Athabasca oil sands region and to anticipate and prepare for potential needs in Cold Lake – Bonnyville, Peace River, and the Industrial Heartland.

As members of the team responsible for preparing this report, we appreciate the opportunity to participate in this important project and hope that our recommendations provide useful direction for the Ministerial Strategy Committee in managing the impact of growth in Alberta's oil sands.

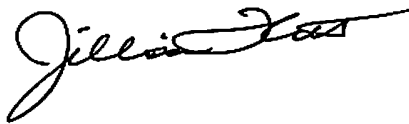
All of which is respectfully submitted,



Doug Radke



Les Lyster



Jillian Flett



Gary Haynes

Appendix 1

Acknowledgements and Methodology

In the course of this work, the Coordinator's office was assisted in many ways by many people. We would like to acknowledge and thank them.

In particular, we wish to thank departments of the Alberta government. We received excellent cooperation from every department involved. Many of them went out their way to conduct research on our behalf or to organize material in ways that were useful to us. Alberta Infrastructure and Transportation, Alberta Energy and Alberta Municipal Affairs were particularly helpful. So, too, was Alberta Health and Wellness.

The Minister of Justice and Attorney General, and Chair of the Oil Sands Ministerial Strategy Committee, provided helpful advice and direction at every stage of the process. We were most impressed with his commitment to the project and the time he was prepared to devote to helping us with our data collection. He led three Ministerial tours to the various oil sands areas and helped open many doors.

Dr. Robert Mansell, Professor of Economics, University of Calgary and Managing Director of the Institute for Sustainable Energy, Environment and Economy, was very generous of his time and knowledge, acting as our technical advisor and reviewing our progress from time to time.

Ron Hicks and his staff in Executive Council ensured that we were able to hire the people we needed to do a credible job, found us space to work in and equipment to support us.

The members and staff of the Regional Industry Working Group for Fort McMurray provided us with a great deal of basic information and helped us to understand the issues involved in providing infrastructure and services in the Fort McMurray area. As well, we learned a great deal about extracting bitumen from sand.

Staff of the Regional Municipality of Wood Buffalo were open and helpful in assisting us to learn of the municipality's problems and opportunities. So, too, were other members of the community in Fort McMurray, Cold Lake, Bonnyville and Peace River.

We spoke to a wide variety of stakeholders, as an information gathering, rather than a consultation process. Other forums including the Oil Sands Multi-stakeholder Consultation Committee have been established to consult on the oil sands issues.

And finally, we need to express our sincere appreciation for the work of our writer, Peggy Garrity, who showed great patience with our constant cries for further revisions, and to Linda Olson who somehow managed to run our little office and keep four free spirits in line.

The information contained in this report is a compilation and analysis from many conversations and many pages of reading material. Due to the short timeframe in which this study was undertaken, most of the recommendations arose from interpretations from existing material, rather than as a result of our own studies. The exceptions were studies we commissioned with the Canadian Energy Research Institute (CERI) to evaluate the

economic impacts of oil sands development and with Nichols Applied Management to assess workforce requirements for Cold Lake – Bonnyville, Peace River and the Industrial Heartland region northeast of Edmonton.

There are a number of population models used by different departments resulting in a wide range of population estimates. A decision was made to rely on a model that had proved relatively accurate in its past predictions (i.e. Nichols Applied Management model). An external audit of the methodology was conducted by an external auditor to confirm there were no concerns about the basic model.

On occasion there were discrepancies in numbers related to things such as spending and capital cost estimates between different sources. This was due to a number of issues including the rapidly changing capital costs as a result of the “Fort McMurray factor.” We relied on the best available data and information to illustrate a relative point rather than to provide the definitive statement on the issue being addressed, such as the final cost of a specific project. Further confirmation, particularly with regard to cost estimates, should be undertaken before relying on specific numbers for decision-making purposes.

This report focuses more on socioeconomic issues rather than environmental issues. This is not a reflection of the relative importance of these issues but rather a reflection of our mandate and of the comprehensive regulatory system currently in place to identify and review environmental issues as opposed to socioeconomic issues. Although some general environmental issues are discussed, it is not intended to be a review of the environmental impacts associated with oil sands development.

The report looks at the socioeconomic impacts of development in Alberta’s three oil sands regions – Athabasca, Cold Lake and Peace River. However, more written material is available on the Athabasca than the Cold Lake or Peace River oil sands region. The projected growth rate for both new and expanded oil sands projects and accompanying population is substantially higher in the Athabasca oil sands area than for Cold Lake or Peace River areas. Much of the growth in the Cold Lake and Peace River areas is a result of conventional heavy oil, rather than oil sands projects. As a result, the focus of the report tends to be on the Athabasca oil sands region.

The issue of the relation of the Industrial Heartland to the overall oil sands boom continually arose. The two issues are so closely linked that we decided a reference to the Industrial Heartland issues was needed to fully understand oil sands growth issues.

Appendix 2

List of Organizations Consulted

Non-Provincial Government

- Alberta Industrial Heartland Association
Larry Wall, Executive Director
- Aspen Health Region #7
Andrew Will, President and Chief Executive Officer
- Athabasca Regional Issues Working Group (RIWG)
Heather Kennedy, Chair
Bob Shepherd, Vice Chair
Brent Stuart, Director, Regional Affairs, Suncor Energy Inc.
- Athabasca Tribal Council
Jim Boucher, President
- BA Energy Inc.
Alexander Hyndman, P.Eng., Vice President and Project Development
Kevin Melyk, General Manager, Heartland Upgrader
- Canadian Association of Petroleum Producers (CAPP)
Oil Sands Executive Policy Group
Onno DeVries, General Manager, Oil Sands and Markets
- Canadian Energy Research Institute Office (CERI)
Phil Prince, President and Chief Executive Officer
Marwan Masri, Vice President
Govinda Timilsina, Senior Research Director
Peter Howard, Research Director
Nichole LeBlanc, Economist
- Canadian Natural Resources Inc. (CNRL)
Peter Kinnear, Senior Advisor, Government and Regulatory Affairs
Scott Stauth, Manager, Eastern Field Operations
- Canadian Pacific Railway
Paul Clegg, Director, Business Analysis and Major Projects
- Cumulative Effects Management Association (CEMA)
John McEachern, Executive Director
Ruth Kleinbub, Treasurer
- City of Cold Lake
Mayor Allan Buck
Ron McCullough, Chief Administrative Officer
- City of Edmonton
Janet Riopel, General Manager, Growth Initiatives, Office of the City Manager
Rick Milligan, Project Manager, Growth Initiatives, Office of the City Manager

- East Central Francophone Education Region No. 3 - Bonnyville
Reg Roy, Chair
- Environment Canada
Margaret Fairbairn, Manager, Environmental Protection Operations
- Fort McKay Metis Local 63
Jim Boucher, Chief
- Fort McMurray Catholic School District
Dan McIssac, Superintendent
Francois Gagnon, Associate Superintendent, Business and Finance
- Fort McMurray Chamber of Commerce
Mike Allen, President
Diane Slater, Manager
- Fort McMurray Emergency Services
Kevin Weinburger, Director
- Fort McMurray Fire Department
Jeff Carlisle, Regional Fire Chief
- Fort McMurray RCMP
Inspector Johnson
- Fort McMurray Public Schools
Kath Ryerson, Superintendent
Allan Kallal, Associate Superintendent, Business and Finance
- Holy Family Catholic Regional School Division #37 – Peace River
Rick Berry, Superintendent
Wayne Doll, Corporate Secretary
- Imperial Oil Resources
Sandy Martin, Cold Lake Operations Manager
Paula McMillan, Community and Aboriginal Affairs Advisor. Cold Lake Operations
- Keyano College
Jim Foote, President
Al Adibi, Vice President, Finance and Administration
Marylea Jarvis, Vice President, Instruction
- Lakeland Catholic School District #150
Bernadette Provost, Superintendent
Vicky Lefebvre, Board Chair
Mary Anne Penner, Trustee for Cold Lake
Kim Kissel, Trustee for Bonnyville
- Municipal District of Bonnyville
Ken Foley, Reeve
Darcy Zelisko, Industrial Liaison Officer
- Nichols Applied Management
Maarten Ingen-Housz, Principal

- Northern Lights Health Region – Fort McMurray
Bernie Blais, Chief Executive Officer
Pat Furey, Vice President, Health Services
Jeff Fitzner, Chair
Lorraine Lynch, Director, Communication and Community Relations
Barb Dipersio, Director, Human Resources
Dr. Alan Nicholson, Medical Director
- Northern Lights School Division #69 (Public) - Bonnyville
Ed Wittchen, Superintendent
Danny Smaiel, Trustee
Heather Welwood, Trustee
- Northern Sunrise County
Agnes Knudsen, Reeve
- Northland School Division #61 (Public) – Peace River
Annette Ramrattan, Superintendent
Len Leithead, Secretary-Treasurer
- Peace County Health Region – Peace River
Sandra Herritt, RN, Director of Health Services
- Peace River & District Chamber of Commerce
Ramona Thoma, President
Brian Reading, Past President
Terry Babie, Vice Chairperson
Patty Savoie, Executive Director
Carla Loree, Programs and Service Coordinator
- Petro-Canada – Fort McMurray
Burt Hunt, Community Affairs Manager
Anne Downey, Manager, In Situ Operations and Technical Services
- Regional Municipality of Wood Buffalo
Melissa Blake, Mayor
Bill Newell, Chief Administrative Officer
Salem Abushawaski, Superintendent
Carole Bouchard, Superintendent, Community Services Department
Patty King, Senior Finance Accountant
Elsie Hutton, Senior Financial Analyst
Beth Sanders, Manager, Planning and Development Department
Laurene Viarobo, Superintendent, Planning & Development Department
Ray Purdy, Acting for RMWB re: EUB Hearing
- Shell Canada – Peace River
Ken Zaitsoff, Public Consultation Officer
- Strathcona County
Mike MacGarva, Manager, Engineering and Environmental Planning
- Sturgeon County
Larry Kirkpatrick, County Commissioner
- Suncor Energy Inc.
Heather Kennedy, Vice President of Employee and Community Relations

Kirk Bailey, Vice President, Strategic Planning and Development
Sue Lowell, Director, Sustainability Strategy
Brent Stuart, Director, Regional Affairs, Employee and Community Relations
Brenda Erskine, Director, Community Relations and Communications

- Syncrude Canada Ltd.
Jim Carter, P.Eng. President and Chief Operating Officer
Philip Lachambre, Executive Vice President and Chief Financial Officer
Don Thompson, Corporate Secretary and General Manager, Environment, Health and Safety
Barbara Shumsky, Manager, Government and Community Affairs
Scott Garner, Team Leader, Financial and Business Controls
Kara Flynn, Team Leader, Public Affairs
- Synergy Group – representing:
MD of Smoky River
Donald Dumont, Reeve
Lou Turcotte, Chief Administrative Officer
Greg Radstaak, Economic Development Officer
Northern Sunrise County
Agnes Knudsen, Reeve
Bob Miles, Chief Administrative Officer
Renee Bernier, Economic Development Officer
MD of Big Lakes
Mylar Saville, Reeve
John Eriksson, Chief Administrative Officer
- Town of Bonnyville
Mayor Ernie Isley
Mark Power, Chief Administrative Officer
- Town of Peace River
Mayor Lorne Mann and Council
Kelly Bunn, Chief Administrative Officer
- University of Calgary Energy Institute
Dr. Robert Mansell
- Wood Buffalo Housing and Development Corporation
Bryan Lutes, President
Ravi Natt, Chairman
Scott Garner, Director

Provincial Government

MLAs

- Honourable Ron Stevens, Minister, Justice and Attorney General
MLA, Calgary-Glenmore
- Honourable Iris Evans, Minister, Health and Wellness
MLA, Sherwood Park
- Honourable Ty Lund, Minister, Infrastructure and Transportation
MLA, Rocky Mountain House

- Honourable Clint Dunford, Minister, Economic Development
MLA, Lethbridge-West
- Honourable Gene Zwozdesky, Minister, Education
MLA, Edmonton-Mill Creek
- Honourable Greg Melchin, Minister, Energy
MLA, Calgary-North West
- Honourable Mike Cardinal, Minister, Human Resources and Employment
MLA, Athabasca-Redwater
- Honourable Guy Boutilier, Minister, Environment
MLA, Fort McMurray-Wood Buffalo
- Honourable Heather Forsyth, Minister, Children's Services
MLA, Calgary-Fish Creek
- Honourable David Coutts, Minister, Sustainable Resource Development
MLA, Livingstone-Macleod
- Honourable Pearl Calahasen, Minister, Aboriginal Affairs and Northern Development
MLA, Lesser Slave Lake
- Honourable Gordon Graydon, Minister, Gaming
MLA, Grande Prairie-Wapiti
- Honourable Rob Renner, Minister, Municipal Affairs
MLA, Medicine Hat
- Honourable Harvey Cenaiko, Solicitor General and Minister, Public Security
MLA, Calgary-Buffalo
- Honourable Yvonne Fritz, Minister, Seniors and Community Supports
MLA, Calgary-Cross
- Honourable Doug Horner, Minister, Agriculture, Food and Rural Development
MLA, Spruce Grove-Sturgeon-St. Albert
- Honourable Denis Herard, Minister, Advanced Education
MLA, Calgary-Egmont
- Honourable Denis Ducharme, Minister of Community Development
MLA, Bonnyville-Cold Lake
- Honourable Ken Kowalski, Speaker
MLA, Barrhead-Mornville-Westlock
- Ray Danyluk, MLA, Lac La Biche-St. Paul
- Hector Goudreau, MLA, Dunvegan-Central Peace
- Rob Lougheed, MLA, Strathcona
- Thomas Lukaszuk, MLA, Edmonton Castle Downs

- Frank Oberle, MLA, Peace River
- Lloyd Snelgrove, MLA, Vermilion-Lloydminster
- Ed Stelmach, MLA, Fort Saskatchewan-Vegreville

Provincial government departments

Aboriginal Affairs and Northern Development

Shelley Ewart-Johnson, Deputy Minister
 Neil Reddekopp, Assistant Deputy Minister, Land and Resource Issues
 Bill Werry, Executive Director, Resource Consultation and Traditional Use

Children's Services

Steve MacDonald, Assistant Deputy Minister, Ministry Support Services Division

Community Development

John Kristensen, Assistant Deputy Minister, Parks and Protected Areas Division

Economic Development

Rick Sloan, Assistant Deputy Minister, Industry and Regional Development Division
 Justin Riemer, Executive Director, Industry Development Branch

Education

Keray Henke, Deputy Minister
 Lois Hawkins, Assistant Deputy Minister, Strategic Services
 Michael Walter, Executive Director, Field Services and School Facilities, Capital Planning
 Margaret King, Senior Advisor, Workforce Planning

Energy

Dan McFadyen, Deputy Minister
 Mike Ekelund, Assistant Deputy Minister, Oil Development
 Tom Ross, Executive Director, Strategic Development
 Larry Ziegenhagel, Acting Executive Director, Strategy, Policy and Evaluation
 Colin Pate, Director, Operational Policy
 Barry Thompson, Director, Scenarios and Forecasting
 David Pollock, Manager, Geology, Resource Land Access
 Martyn Griggs, Senior Advisor, Oil Sands Development
 Soheil Asgarpour, Business Leader, Oil Sands Development
 Chris Hale, Senior Environmental Scientist, Fort McMurray Regional Office
 Chris Holly, Issues Manager, Oil Development
 Tom Churchill, Geological Technologist, Geology

Environment

Peter Watson, Deputy Minister
 Jay Nagendran, Assistant Deputy Minister, Regional Services
 Ernie Hui, Director, Northern Region

Executive Council

Ron Hicks, Deputy Minister

Finance

Brian Manning, Deputy Minister
 Grant Robertson, Assistant Deputy Minister, Budget and Fiscal Planning
 Mike Wevers, Executive Director, Budget and Business Planning

Tony Morehen, Executive Director, Economics and Public Finance
Bill Hyshka, Manager, Statistics
Jolene Pischke, Research Officer, Economics and Public Finance, Statistics

Health and Wellness

Paddy Meade, Deputy Minister
Annette Trimbee, Assistant Deputy Minister, Strategic Directions Division
Barry Andres, Executive Director, Prevention and Outpatient Services Branch
Alexander MacKenzie, Executive Director, Health Surveillance
Jason Cobb, Executive Policy Manager, Office of Deputy Minister

Human Resources and Employment

Ulysses Currie, Deputy Minister
Diane Paul, Senior Manager, Economic and Demographic Analysis
Ali Abdelrahman, Senior Economist, Data Development and Evaluation

Infrastructure and Transportation

Jay Ramotar, Deputy Minister
Roderick Thompson, Ph.D, Executive Director, Strategic Policy
Vince Wu, Director, Highway and Municipal Policy
Keir Packer, Senior Policy Advisor, Freight Transportation & Trade

Justice and Attorney General

Ray Bodnarek, QC, Director, Seconded Legal Services, Civil Law Branch

Municipal Affairs

Dan Bader, Deputy Minister
Brian Quickfall, Assistant Deputy Minister, Local Government Services Division
Wayne Jackson, Director, Strategic Projects
Pamela Steppan, Manager, Policy Research, Strategic Projects
Karen Wronko, Manager, Revenue Analysis, Strategic Projects
Victoria Brown, Manager, Planning, Strategic Projects

Northern Alberta Development Council

Dan Dibbelt, Executive Director, Aboriginal Affairs and Northern Development
Jennifer Bisley, Senior Northern Development Officer

Oil Sands Consultation Multi-stakeholder Committee

Vance MacNichol, Chair

Seniors and Community Supports

Tim Wiles, Deputy Minister
Robin Wigston, Assistant Deputy Minister, Housing Services Division

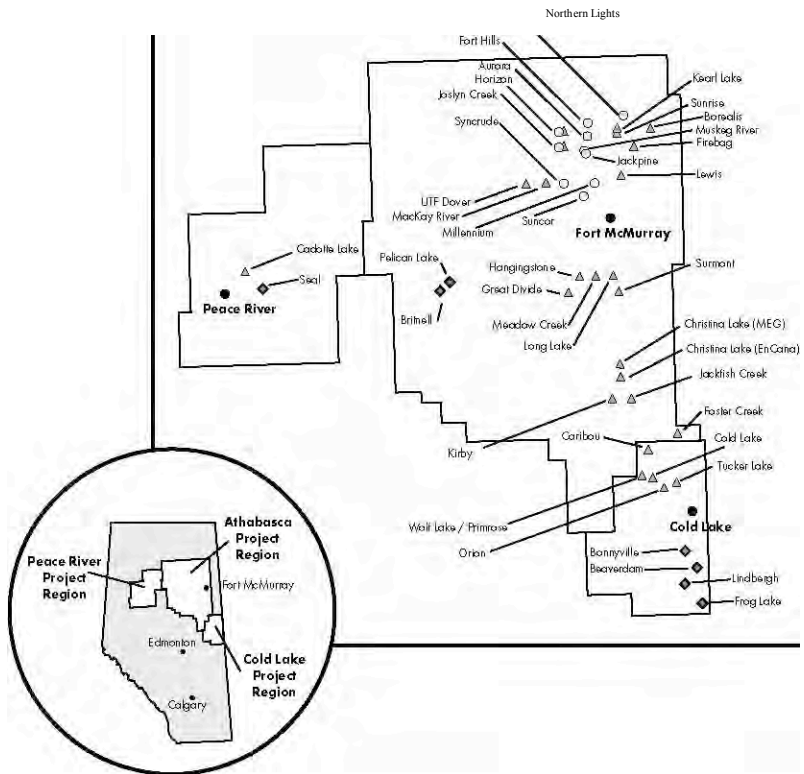
Solicitor General and Public Security

Eric McGhan, Deputy Minister and Deputy Solicitor General
Gloria Ohrt, Senior Manager, General and Contract Policing

Sustainable Resource Development

Brad Pickering, Deputy Minister

Appendix 3 Major Oil Sands Projects



LEGEND

In Situ Projects

Orion
Kirby
Wolf
Lake/Primrose
Surmont
Great Divide
UTF (Dover)
Jackfish Creek
Borealis
Christina Lake
Foster Creek
Caribou
Sunrise
Tucker Lake
Cold Lake
Hangingsone
Christina Lake
Long Lake
Lewis
MacKay River
Meadow Creek
Cadotte Lake
Firebag
Joslyn Creek

Operator

BlackRock Ventures
Canadian Natural Resources
Canadian Natural Resources
ConocoPhillips/Total
Connacher Oil and Gas
Devon Energy
Devon Energy
EnCana
EnCana
EnCana
Husky Energy
Husky Energy
Husky Energy
Imperial Oil
Japan Canada Oil Sands (JACOS)
MEG
OPTI/Nexen
Petro-Canada
Petro-Canada
Petro-Canada/Nexen
Shell Canada
Suncor Energy
Total E&P Canada

Mining Projects Operator

Muskeg River Albian Sands (Shell/Chevron/Western Oil Sands)
Jackpine Mine Albian Sands (Shell/Chevron/Western Oil Sands)
Horizon* Canadian Natural Resources
Kearl Lake Imperial Oil
Suncor Base Mine Suncor Energy
Millennium Suncor Energy
Syncrude Base Mine Syncrude Joint Venture
Aurora Syncrude Joint Venture
Northern Lights Synenco
Fort Hills Petro-Canada/UTS Energy/Teck Cominco
Joslyn Creek Total E&P Canada

Major Primary Production Areas

SEAL
Pelican Lake
Lindbergh
Frog Lake
Brintnell
Bonnyville
Beaverdam

* Includes plans for both in situ and mining

Mining/Extraction and Upgrading Projects

Company/Project Name	Project Status	Startup Date	Bitumen Capacity		
			(b/d)	(m ³ /d)	
Athabasca Oil Sands Project					
Muskeg River Mine					
	Existing Facilities	Operating	2002	155,000	24 600
	Expansion and Debottleneck	Application	2010	115,000	18 300
Jackpine Mine					
	Phase 1A	Approved	2010	100,000	15 900
	Phase 1B	Approved	2012	100,000	15 900
	Phase 2	Disclosure	2014	100,000	15 900
Scotford Upgrader					
	Phase 1	Operating	2003	155,000	24 600
	Debottleneck	Application	2007	45,000	7 100
	Expansion	Application	2009	90,000	14 300
CNRL					
Horizon Mine & Upgrader					
	Phase 1	Construction	2008	135,000	21 400
	Phase 2	Approved	2011	45,000	7 100
	Phase 3	Approved	2011	90,000	14 300
	Phase 4	Announced	2015	145,000	23 000
	Phase 5	Announced	2017	162,000	25 700
Primrose Upgrader					
	Phase 1	Announced	2012	145,000	23 000
	Phase 2	Announced	2015	58,000	9 200
Fort MacKay First Nation					
Fort MacKay Mine					
	Phase 1	Announced	TBD	TBD	TBD
Husky					
Lloydminster Upgrader					
	Existing Operations	Operating	1992	71,000	11 300
	Debottleneck	Construction	2006	12,000	1 900
	Expansion	announced	TBD	67,000	10 600
Imperial/ExxonMobil					
Kearl Mine					
	Phase 1	Application	2010	100,000	15 900
	Phase 2	Application	2012	100,000	15 900
	Phase 3	Application	2018	100,000	15 900

Mining/Extraction and Upgrading Projects (continued)

Company/Project Name	Project Status	Startup Date	Bitumen Capacity		
			(b/d)	(m ³ /d)	
OPTI/Nexen					
Long Lake Upgrader					
	Phase 1	Construction	2007	72,000	11 400
	Phase 2 (south)	Approved	2011	72,000	11 400
	Phase 3	Announced	2013	72,000	11 400
	Phase 4	Announced	2015	72,000	11 400
Petro-Canada/UTS/Teck Cominco					
Fort Hills Mine					
	Phase 1/2	Approved	2011	100,000	15 900
	Phase 3/4	Approved	2014	90,000	14 300
Fort Hills Upgrader					
	Phase 1/2	Announced	2011	100,000	15 900
	Phase 3/4	Announced	2014	90,000	14 300
Suncor					
Steepbank & Millennium Mine					
	Steepbank & N.Steepbank Extension	Operating	1967	276,000	43 800
	Steepbank Debottleneck	Construction	2006	25,000	4 000
	Millennium Debottleneck	Construction	2008	23,000	3 700
Tar Island Upgrader					
	Base U1 and U2	Operating	1967	281,000	44 600
	Millennium Vacuum Unit	Operating	2005	43,000	6 800
	Millennium Coker Unit	Construction	2008	116,000	18 400
Voyageur Upgrader					
	Phase 1	Application	2010	156,000	24 800
	Phase 2	Application	2012	78,000	12 400
Syncrude					
Mildred Lake & Aurora Mining and Upgraders					
	Existing Facilities	Operating	1978	290,700	46 100
	Stage 3 Expansion	Construction	2006	116,300	18 500
	Stage 3 Debottleneck	Announced	2011	46,500	7 400
	Stage 4 Expansion	Announced	2015	139,500	22 100
Synenco					
Northern Lights Mine					
	Phase 1	Disclosure	2009	50,000	7 900
	Phase 2	Disclosure	2011	50,000	7 900
Northern Lights Upgrader					

	Phase 1	Disclosure	2010	50,000	7 900
	Phase 2	Disclosure	2012	50,000	7 900

Mining/Extraction and Upgrading Projects (continued)

Company/Project Name	Project Status	Startup Date	Bitumen Capacity		
			(b/d)	(m ³ /d)	
total E&P (formerly Deer Creek)					
Joslyn mine					
	Phase 1 (north)	application	2010	50,000	7 900
	Phase 2 (north)	Application	2013	50,000	7 900
	Phase 3 (south)	Announced	2016	50,000	7 900
	Phase 4 (south)	Announced	2019	50,000	7 900
Joslyn/Surmont Upgrader					
	Phase 1	Announced	2010	50,000	7 900
	Phase 2	Announced	2013	50,000	7 900
Value Creation					
North Joslyn Upgrader					
	Phase 1	Announced		40,000	6 300

Merchant Upgraders

Company/Project Name	Project Status	Startup Date	Bitumen Capacity		
			(b/d)	(m ³ /d)	
BA Energy					
Heartland Upgrader					
	Phase 1	Construction	2008	54,400	8 600
	Phase 2	Approved	2010	54,400	8 600
	Phase 3	Approved	2012	54,400	8 600
BA Energy North West Upgrading					
North West Upgrade					
	Phase 1	Application	2010	50,000	7 900
	Phase 2	Application	2013	54,400	7 900
	Phase 3	Application	2016	54,400	7 900
Peace River Oil Upgrading					
Bluesky Upgrader					
	Phase 1	Announced	2010	25,000	4 000
	Phase 2	Announced	TBD	25,000	4 000
	Phase 3	Announced	TBD	25,000	4 000
	Phase 4	Announced	TBD	25,000	4 000

In Situ Projects

Athabasca Oil Sands Area In Situ Projects						
Company/Project Name	Project Status	Startup Date	Bitumen Capacity			
			(b/d)	(m ³ /d)		
CNRL						
Birch Mountain						
	Phase 1	Announced	2013	30,000	4 800	
	Phase 2	Announced	2015	30,000	4 800	
Gregoire Lake						
	Phase 1	Announced	2016	30,000	4 800	
	Phase 2	Announced	2018	30,000	4 800	
	Phase 3	Announced	2020	30,000	4 800	
	Phase 4	Announced	2023	30,000	4 800	
Kirby						
	Phase 1	Approved	2011	30,000	4 800	
Connacher						
Great Divide						
	Phase 1	Application	2006	10,000	1 600	
ConocoPhillips						
Sumont						
	Phase 1	Construction	2006	25,000	4 000	
	Phase 2	Approved	2008	25,000	4 000	
	Phase 3	Approved	2011	25,000	4 000	
	Phase 4	Approved	2014	25,000	4 000	
Devon						
Jackfish						
	Jackfish 1	Construction	2008	35,000	5 600	
	Jackfish 2	Disclosure	2010	35,000	5 600	
EnCana						
Borealis						
	Phase 1	Announced	2010	20,000	3 200	
	Phase 2	Announced	2011	20,000	3 200	
	Phase 3	Announced	2012	20,000	3 200	
	Phase 4	Announced	2013	20,000	3 200	
	Phase 5	Announced	2014	20,000	3 200	

Athabasca Oil Sands Area In Situ Projects (continued)

Company/Project Name		Project Status	Startup Date	Bitumen Capacity	
				(b/d)	(m ³ /d)
Christina Lake					
	Phase 1A	Operating	2002	10,000	1 600
	Phase 1B	Approved	2008	30,000	4 800
	Phase 1C	Approved	2009	30,000	4 800
	Phase 1d	Announced	2010	30,000	4 800
	Unnamed Expansion 1	Announced	2011	30,000	4 800
	Unnamed Expansion 2	Announced	2012	30,000	4 800
	Unnamed Expansion 3	Announced	2013	30,000	4 800
	Unnamed Expansion 4	Announced	2014	30,000	4 800
	Unnamed Expansion 5	Announced	2015	30,000	4 800
Foster Creek					
	Phase 1A	Operating	2001	24,000	3 800
	Phase 1B - Debottleneck	Operating	2003	6,000	1 000
	Phase 1C - Stage 1	Operating	2005	10,000	1 600
	Phase 1C - Stage 2	Construction	2006	20,000	3 200
	Phase 1D	Announced	2006	20,000	3 200
	Phase 1E	Announced	2007	20,000	3 200
	Unnamed Expansion 1	Announced	2009	25,000	4 000
	Unnamed Expansion 2	Announced	2011	25,000	4 000
Husky					
Sunrise					
	Phase 1	Approved	2008	50,000	7 900
	Phase 2	Approved	2010	50,000	7 900
	Phase 3	Approved	2012	50,000	7 900
	Phase 4	Approved	2014	50,000	7 900
JACOS					
Hangingstone					
	Pilot	Operating	2002	10,000	1 600
	Phase 1	Disclosure	2010	25,000	4 000
	Phase 2	Disclosure	2012	25,000	4 000
MEG					
Christina Lake					
	Pilot	Construction	2007	3,000	500
	Commercial	Application	2008	22,000	3 500

Athabasca Oil Sands Area In Situ Projects (continued)

Company/Project Name		Project Status	Startup Date	Bitumen Capacity	
				(b/d)	(m ³ /d)
North American					
Kai Kos Dehseh					
	Phase 1	Announced	2008	10,000	1 600
	Phase 2	Announced	2010	30,000	4 800
	Phase 3	Announced	2011	40,000	6 300
	Phase 4	Announced	2013	40,000	6 300
	Phase 5	Announced	2015	40,000	6 300
Opti/Nexen					
Long Lake					
	pilot	Operating	2003	2,500	400
	Phase 1	Construction	2006	72,000	11 400
	Phase 2 (South)	Disclosure	2010	72,000	11 400
	Phase 3	Announced	2012	72,000	11 400
	Phase 4	Announced	2014		
Orion					
Whitesands					
	Pilot	Startup	2006	2,000	300
Petro-Canada					
Chard					
	Phase 1	Announced	TBD	40,000	6 300
Dover					
	SAGD Pilot	Operating	2001	1,400	200
	VAPEX Pilot	Operating	2003	100	16
Lewis					
	Phase 1	Disclosure	TBD	40,000	6 300
	Phase 2	Disclosure	TBD	40,000	6 300
MacKay River					
	Phase 1	Operating	2002	33,000	5 200
	Phase 2	Application	2009	40,000	6 300
Meadow Creek					
	Phase 1	Approved	TBD	40,000	6 300
	Phase 2	Approved	TBD		
Lewis					
	phase 1	Disclosure	TBD	40,000	6 300
	phase 2	Disclosure	TBD	40,000	6 300

Athabasca Oil Sands Area In Situ Projects (continued)

Company/Project Name		Project Status	Startup Date	Bitumen Capacity	
				(b/d)	(m ³ /d)
Suncor					
Firebag					
	Phase 1	Operating	2004	33,000	5 200
	Phase 2	Operating	2006	35,000	5 600
	Cogeneration and Expansion	Construction	2009	25,000	4 000
	Phase 3	Approved	2008	35,000	5 600
	Phase 4	Approved	2009	35,000	5 600
	Phase 5	Announced	2012	50,000	7 900
	Phase 6	Announced	2013	50,000	7 900
	Phase 7	Announced	2014	50,000	7 900
	Phase 8	Announced	2015	63,000	10 000
Total E&P (Deer Creek)					
Joslyn					
	Phase 1	Operating	2004	2,000	300
	Phase 2	Construction	2006	10,000	1 600
	Phase 3A	Disclosure	2009	15,000	2 400
	Phase 3B	Disclosure	2011	15,000	2 400
Value Creation					
Halfway Creek					
	Phase 1	Announced	2009	10,000	1 600
North Joslyn					
	Phase 1	Announced	TBD	40,000	6 300

Cold Lake Oil Sands Area In Situ Projects

Company/Project Name		Project Status	Startup Date	Bitumen Capacity	
				(b/d)	(m ³ /d)
BlackRock					
Orion (Hilda Lake)					
	Pilot	Operating	1997	500	100
	Phase 1	Approved	2007	10,000	1 600
	Phase 2	Approved	2009	10,000	1 600
CNRL					
Primrose					
	Primrose South	Operating	1985	50,000	7 900
	Primrose North	Construction	2006	30,000	4 800

	Primrose East	Application	2009	30,000	4 800
--	---------------	-------------	------	--------	-------

Cold Lake Oil Sands Area In Situ Projects (continued)

Company/Project Name		Project Status	Startup Date	Bitumen Capacity	
				(b/d)	(m ³ /d)
Husky					
	Tucker Lake				
	Phase 1	Construction	2006	30,000	4 800
Imperial Oil					
	Cold Lake				
	Phases 1-10: Leming, Maskwa, Mahikan	Operating	1985	110,000	17 500
	Phases 11-13: Mahkeses	Operating	2003	30,000	4 800
	Phases 14-16: Nabiye, Mahikan North	Construction	2006	30,000	4 800

Peace River In Situ Projects

Company/Project Name		Project Status	Startup Date	Bitumen Capacity	
				(b/d)	(m ³ /d)
Shell					
	Cadotte Lake				
	Pilot	Operating	1979	1,000	200
	Phase 1	Operating	1986	11,000	1 700
Carmon Creek					
	Phase 1	Disclosure	2009	18,000	2 900
	Phase 1 Expansion	Announced	2012	35,000	5 600
	Phase 2	Announced	2015	35,000	5 600

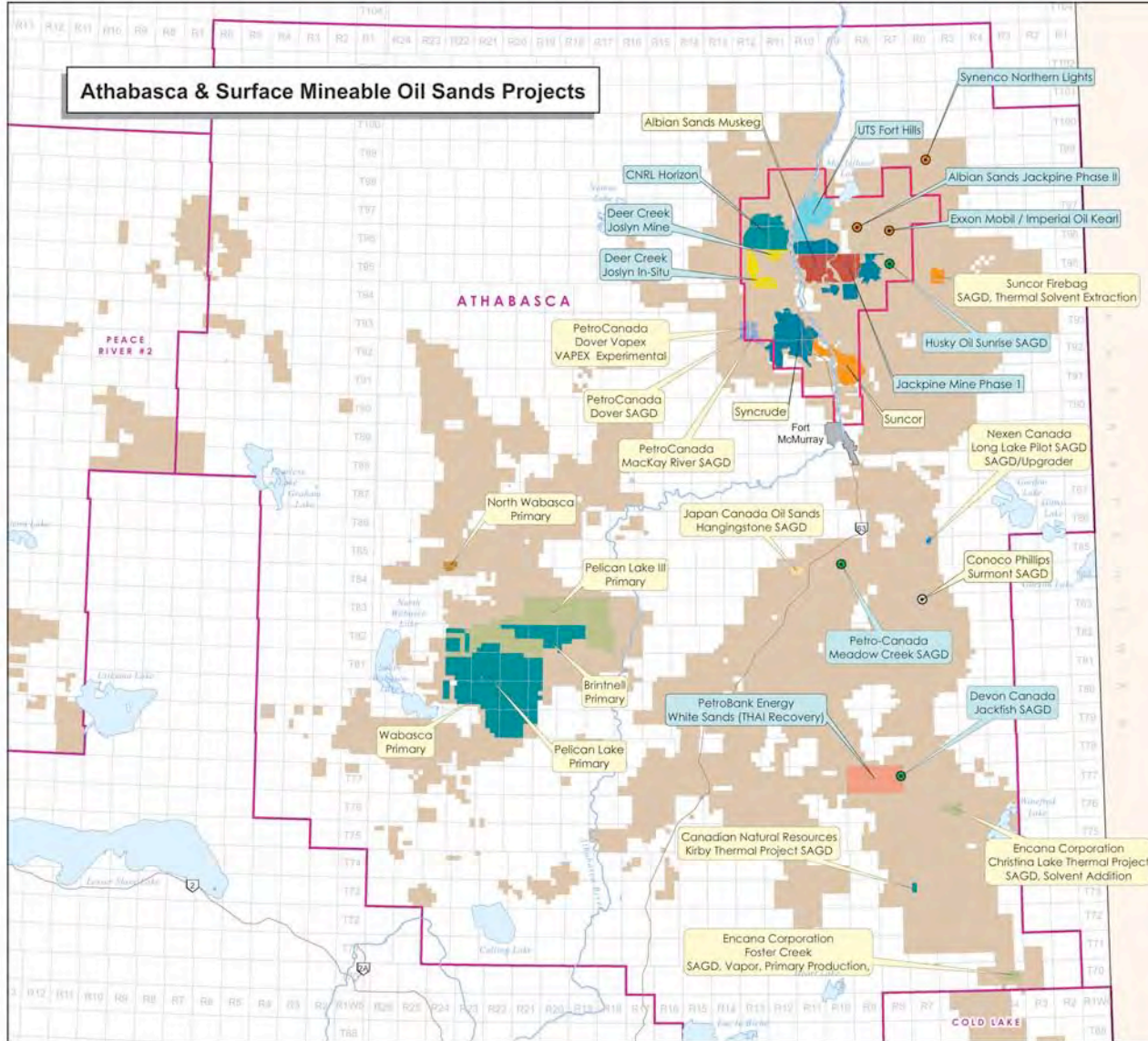
Source: National Energy Board, Strategy West Inc., Alberta Economic Development

Appendix 4

Selected maps

1. Athabasca Oil Sands Projects
2. Cold Lake Oil Sands Projects
3. Peace River Oil Sands Projects
4. Potential sites for housing developments – Fort McMurray urban service area
5. Current status of Highways 63 and 881

Athabasca & Surface Mineable Oil Sands Projects



Athabasca Oil Sands Area

Project Name	Stage of Development
Integrated Mining Projects	
Muskeg River	Producing Mine
Jackpine Mines Phase I & II	Proposed
Horizon	Under construction
Kearl	Proposed
Syncrude 21	Producing mine
Suncor Steepbank/Millennium	Producing mine
Standalone Mining Projects	
Fort Hills	Proposed
Northern Lights	Proposed
Integrated SAGD	
Long Lake	Producing Plant
Surmont	Producing Plant
Standalone SAGD Projects	
Christina Lake	Producing plant
Dover (VAPEX-SAGD)	Experimental
Dover SAGD	Producing plant
Foster Creek	Producing plant
Hangingstone	Pilot plant
Joslyn	Under construction
Jackfish	Under construction
Kirby	Suspended
Mackay River	Producing plant
Meadow Creek	Construction on hold
Suncor Firebag	Producing plant
Sunrise	Proposed
White Sands (THAI Recovery)	Proposed
Primary Projects	
Brintnell	Producing wells
Pelican Lake	Producing wells
Wabasca	Producing wells
Pelican Lake	Producing wells
North Wabasca	Producing wells

- Canadian Natural Resources
- Deer Creek Energy
- Encana Corporation
- Exxon Mobil / Imperial Oil
- Japan Canada Oil Sands
- Koch Exploration Canada
- Nexen Canada
- PetroBank Energy
- PetroCanada
- Shell Canada
- Suncor
- Syncrude
- UTS Corporation
- Proposed Mine
- Proposed Thermal Project
- Existing Thermal Project
- Oil Sands Agreements
- Oil Sands Area
- Surface Mineable Area
- Municipality
- ~ Hydrography
- Major Highway
- Existing Projects
- Proposed Projects

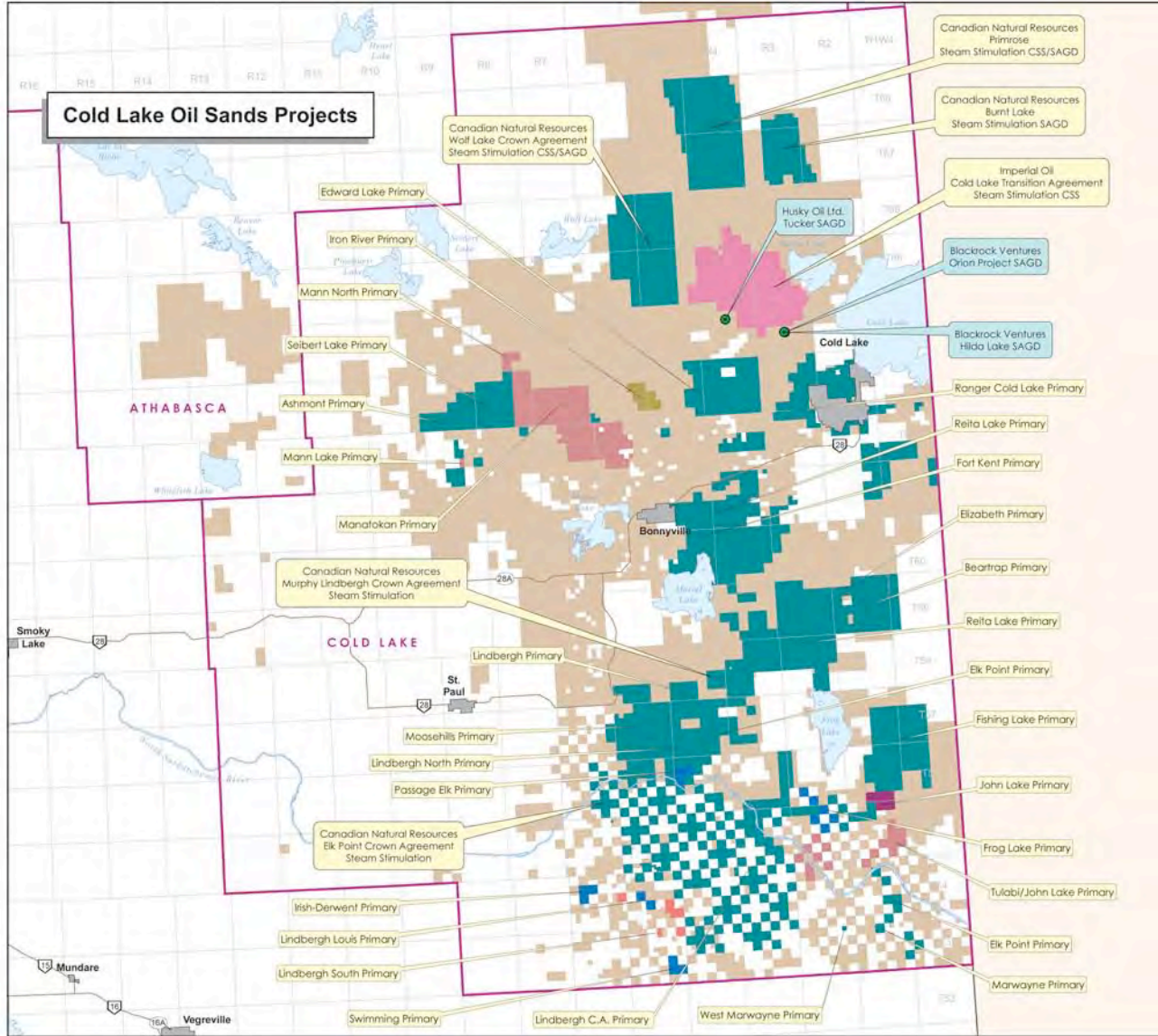
Transverse Mercator Projection (10TM)
North American Datum 1983 (NAD83)

Source Information:
 Projects: Department of Energy
 Oil Sands Agreements: Department of Energy
 Oil Sands & Surface Mineable Areas: Department of Energy
 Base Data provided by Spatial Data Warehouse Ltd.

Disclaimer:
 Information presented on this map originates from various sources and is for general use only.
 Please be advised that some information may have been added, amended and deleted since the map was created.

Author: GIS Mapping & Data Services
 Date: January 2008

Cold Lake Oil Sands Projects



Cold Lake Oil Sands Area		Stage of Development
Thermal CSS Project		
Cold Lake		Producing plant
Elk Point Crown Agreement		Producing plant
Murphy Lindbergh Crown Agreement		Producing plant
SAGD Projects		
Burnt Lake		Producing plant
Hilda Lake		Under construction
Orion		Experimental project
Primrose/Wolf Lake		Producing plant
Tucker		Proposed
Primary Projects		
Ashmont		Producing wells
Beartrap		Producing wells
Ranger Cold Lake		Producing wells
Edward Lake		Producing wells
Elizabeth		Producing wells
Elk Point		Producing wells
Fishing Lake		Producing wells
Fort Kent		Producing wells
Frog Lake		Producing wells
Irish-Derwent		Producing wells
Iron River		Producing wells
John Lake		Producing wells
Lindbergh		Producing wells
Lindbergh Crown Agreement		Producing wells
Lindbergh Louis		Producing wells
Lindbergh North		Producing wells
Lindbergh South		Producing wells
Mann Lake		Producing wells
Mann North		Producing wells
Manatokan		Producing wells
Marwayne		Producing wells
Moose Hills		Producing wells
Passage Elk		Producing wells
Reita Lake		Producing wells
Seibert Lake		Producing wells
Swimming		Producing wells
Tulabi/John Lake		Producing wells
West Marwayne		
		Producing wells

- Bonavista Petroleum
- Canadian Natural Resources
- Delphi Energy Corp.
- Devon Canada
- ExxonMobil Canada
- Imperial Oil
- Krang Energy
- Proposed Thermal Project

- Oil Sands Agreements
- Oil Sands Area
- Municipality
- Hydrography
- Major Highway

Transverse Mercator Projection (10TM)
North American Datum 1983 (NAD83)

Source Information:
Projects: Department of Energy
Oil Sands Agreements: Department of Energy
Oil Sands & Surface Mineable Areas: Department of Energy
Base Data provided by Geopac Data Viewhouse Ltd

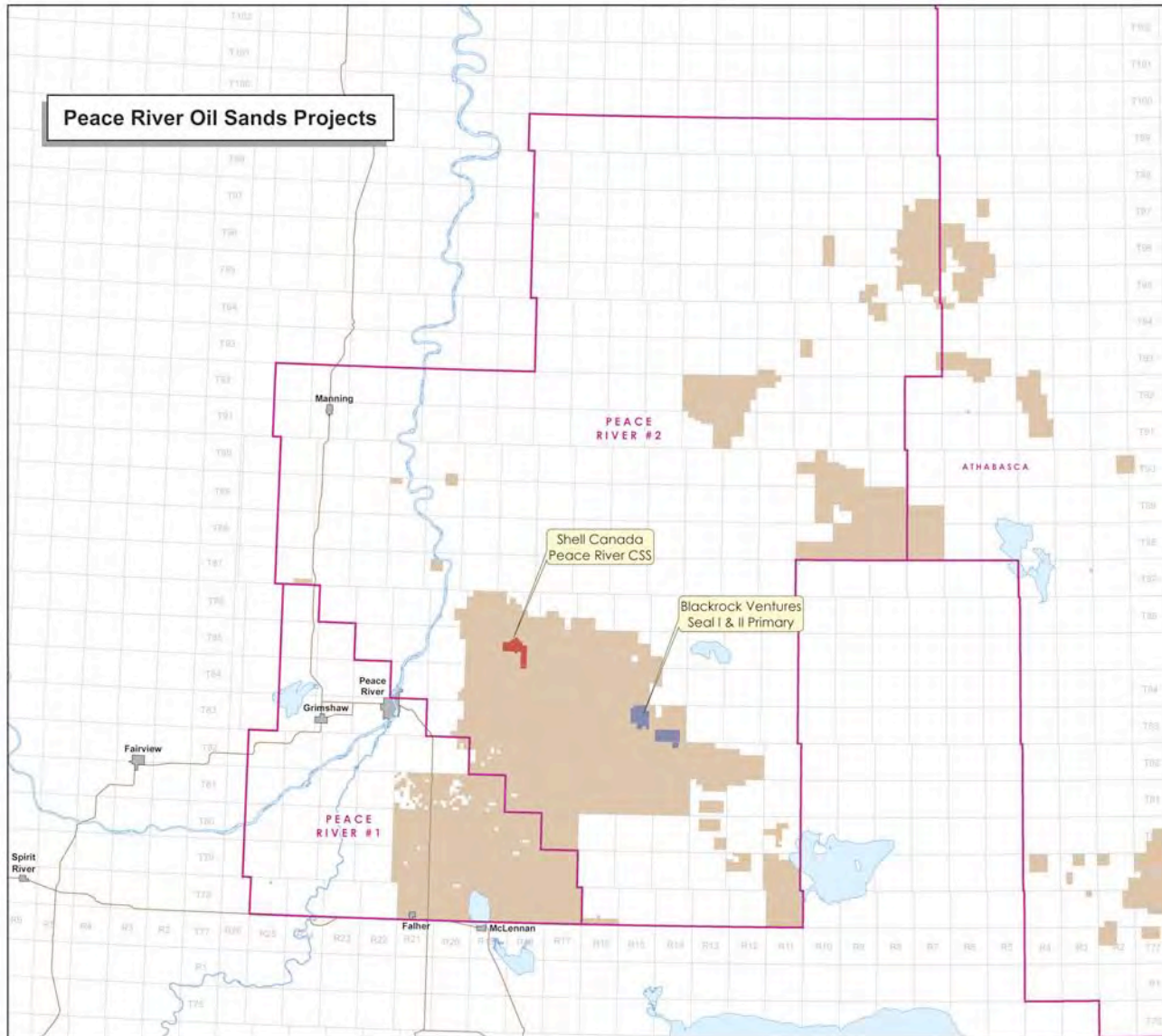
Disclaimer:
Information presented on this map originates from various sources and is for general use only.
Please be advised that some information may have been added, amended and deleted since this map was created.

Author: GIS Mapping & Data Services
Date: January 2006

Edmonton

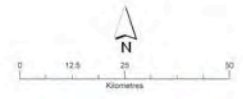
Calgary

Peace River Oil Sands Projects



Peace River Oil Sands Area		Stage of Development
Primary Projects		
Seal I, II		Producing wells
CSS Thermal Projects		
Peace River		Producing plant

- Blackrock Ventures
- Shell Canada
- Oil Sands Agreements
- Oil Sands Area
- Municipality
- Hydrography
- Major Highway
- Testing Projects
- Proposed Projects

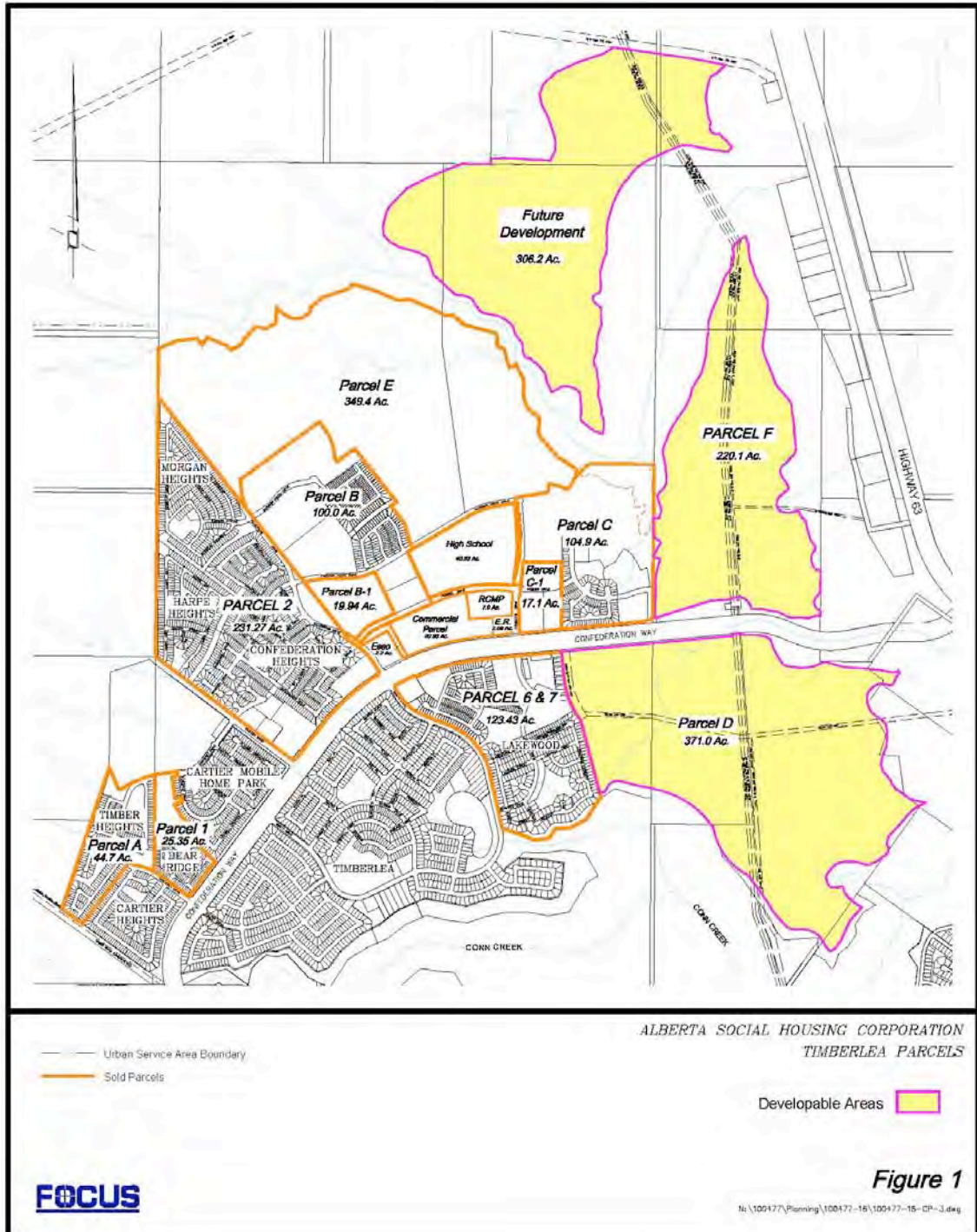


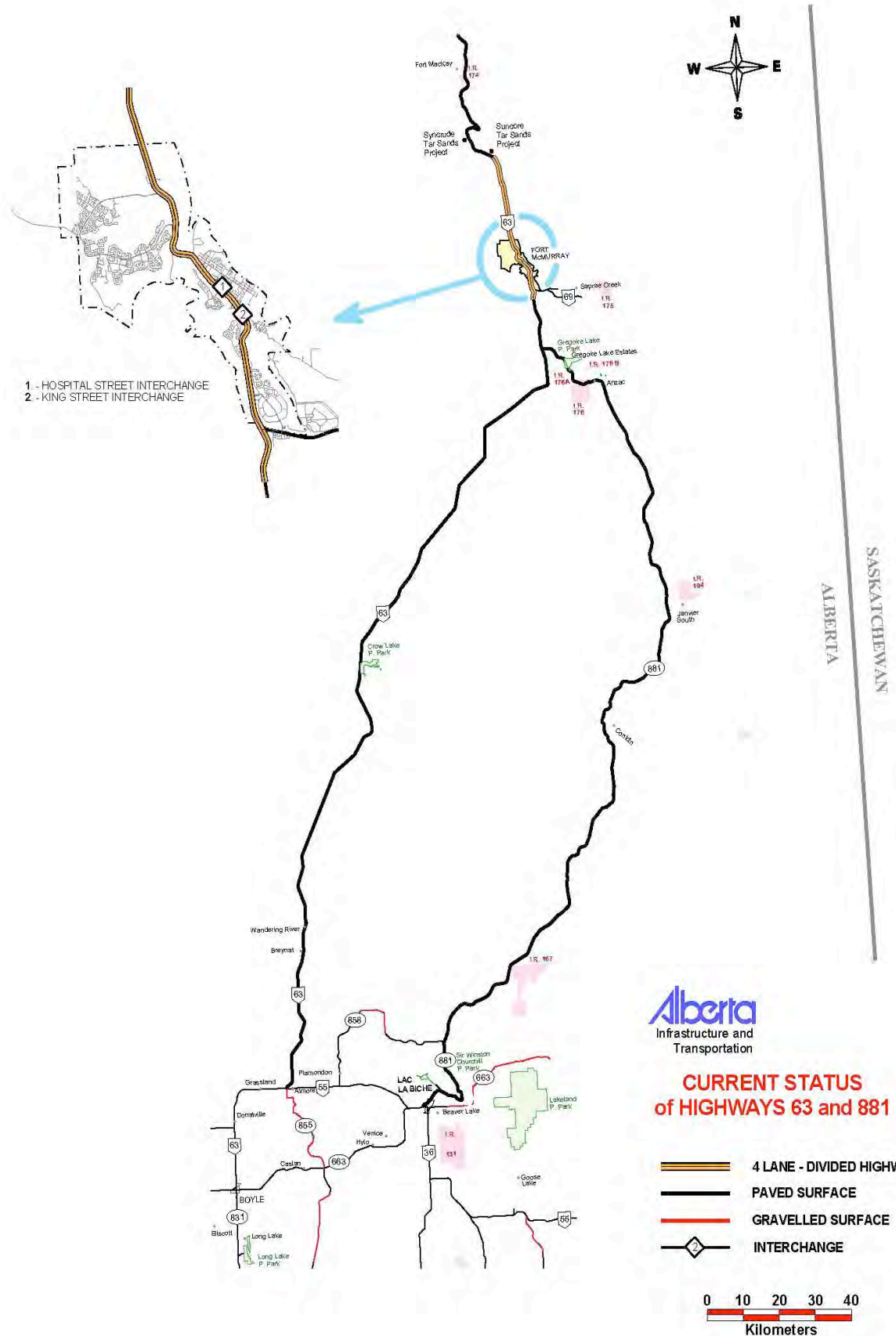
Transverse Mercator Projection (10TM)
 North American Datum 1983 (NAD83)

Source Information:
 Projects: Department of Energy
 Oil Sands Agreements: Department of Energy
 Oil Sands & Surface Mineable Areas: Department of Energy
 Base Data provided by Spatial Data Warehouse Ltd.

Disclaimer:
 Information presented on this map originates from various sources and is for general use only.
 Please be advised that some information may have been added, amended and deleted since this map was created.

Author: GIS Mapping & Data Services
 Date: January 2009





Bibliography

- Alberta Chamber of Commerce. "Oil Sands Technology Roadmap" – Unlocking the Potential." January 2004.
- Alberta Construction Workforce. "Supply/Demand Forecast-2005-2009 Summary Report." May 2005.
- Alberta Economic Development. "Economic Scenarios-Future Growth Paths for the Alberta Economy." April 2006.
- Alberta Economic Development. "Oil Sands Industry Update." June 2006.
- Alberta Economic Development. "Securing Tomorrow's Prosperity." Summer 2005.
- Alberta Economic Development. "Securing Tomorrow's Prosperity-Plan the Work, Work the Plan." September 2006.
- Alberta Economic Development. "Trends and Outlook." September 2006.
- Alberta Education. "Accountability Rollover Summary for: Peace River School District. No. 10; Fort McMurray Public School District No. 2833; Fort McMurray Roman Catholic Separate School District No. 33; Holy Family Catholic Regional Division No. 37; Lakeland Roman Catholic Separate School District No. 150; Northland School Division No. 61; Northern Lights School Division No. 69." 2006.
- Alberta Education. "The Renewed Funding Framework for K-12 Classrooms in Alberta – 2006/2007 School Year." August 2006.
- Alberta Energy. "Alberta's Integrated Energy Vision." August 2006.
- Alberta Energy. Alberta Oil Sands Consultations Fact Sheets: Capital Planning; Alberta Oil Sands; Alberta Municipal Grants; Alberta's First Nations Consultation Policy on Land Management and Resource Development; Caribou Management; Crude Bitumen Reserves; Facts on Air Quality in Alberta's Oil Sands Areas; Facts on Climate Change in Alberta's Oil Sands Areas; Facts on Land Reclamation in Alberta's Oil Sands Areas; Facts on Oil; First Nations and Métis Constitutionally Protected Rights; Facts on Water Management in Alberta's Oil Sands Areas; Forest Management; Fort McMurray Infrastructure and Municipal Support; Highway Infrastructure for the Cold Lake, Fort McMurray and Peace River Regions; Municipal Infrastructure Funding for the Cold Lake, Fort McMurray and Peace River Areas; Oil Sands Recorded History; Oil Sands Royalties; Oil Sands Tenure; Traditional Use Studies; Water Use by Alberta's Oil and Gas Industry; Wetlands Management; Wildlife Management. September 2006.
- Alberta Energy. "Mineable Oil Sands Strategy." October 2005.
- Alberta Energy. "Oil and Gas Fiscal Regimes – Western Canadian Provinces and Territories." November 2003.
- Alberta Energy. "Opportunities and Challenges of Oil Sands Development. - Fort McMurray" September 2006.
- Alberta Energy and Utilities Board. "Alberta's Energy Reserve 2005 and Supply/Demand Outlook 2006-2015." May 2006.

Alberta Energy and Utilities Board. "Suncor Energy Inc. – Application for Expansion of an Oil Sands Mine (North Steepbank Mine Extension) and a Bitumen Upgrading Facility (Voyageur Upgrader) in the Fort McMurray Area." November 2006.

Alberta Energy and Utilities Board. "Suncor Energy Inc. – Application for an Oil Sands Primary Extraction Facility Fort McMurray Area." June 2006.

Alberta Environment. "Regional Sustainable Development Strategy for the Athabasca Oil Sands Area (RSDS)." 2006.

Alberta Environment. "Water For Life Strategy." August 2006.

Alberta Environment and Fisheries and Oceans Canada. "Water Management Framework: Instream Flow Needs and Water Management System for the lower Athabasca River." July 2006.

Alberta Finance. "Alberta Population Report – Second Quarter, 2006." September 2006.

Alberta Finance. "Budget 06 – Strengthening Today, Securing Tomorrow - Economic Outlook 2006-09." March 2006.

Alberta Finance. "Net In-Migration for Alberta." 2006.

2006-09 Ministry Business Plans. Aboriginal Affairs and Northern Development; Advanced Education; Community Development; Economic Development; Education; Energy; Environment; Finance; Health and Wellness; Human Resources and Employment; Infrastructure and Transportation; Justice and Attorney General; Municipal Affairs; Seniors and Community Supports; Sustainable Resource Development. March 2006.

Alberta Forest Products Association. "Alberta Forest Usage Survey Results". May 2006

Alberta Health and Wellness. "Alberta Health Care Insurance Plan – Statistical Supplement 2004/2005." 2004/2005

Alberta Health and Wellness. "Annual Report 2005/2006 – Section I; Annual Report 2005/2006 – Section II." 2005/2006.

Alberta Health and Wellness. "Population Projections for Alberta and its Health Regions – 2004-2033." March 2005.

Alberta Health and Wellness. "Report on Health of Albertans." February 2006.

Alberta Health and Wellness. "Alberta Regional Population Outlook, 2006-2011." August 2006.

Alberta's Industrial Heartland. "Adding Value to Alberta's Oil Sands." November 2006.

Alberta Infrastructure and Transportation. "Fort McMurray Infrastructure Support". June 2006.

Alberta Municipal Affairs. "Fort McMurray Land Release Update." September 2006.

Alberta Municipal Affairs. "Land Release Strategy – Fort McMurray Urban Development Land Release – Interdepartmental Plan." June 2006.

Alberta Municipal Affairs and the Wood Buffalo Interdepartmental Committee with Nichols Applied Management. "Wood Buffalo Issues Report and Recommendations Regarding a Submission by the Athabasca Oil Sands Developers Facilitation Committee". October 2003.

- Alberta Sustainable Resource Development. "Alberta Biodiversity Monitoring Program – Program Overview and Consultation Backgrounder." July 2005
- Alberta Solicitor General and Public Security. "Draft - Policing in Alberta – A guide to policing services for municipalities." January 2006.
- Albian Sands Energy Inc. "Presentation to the Oil Sands Multi-Stakeholder Committee." September 2006.
- Albian Sands Energy Inc. Binder. "Index." 2006
- A. Government of Alberta Submissions
 - 1. Draft Submission #3 – August 9, 2006
 - B. Interveners Submissions
 - 1. Government of Canada
 - 2. Regional Municipality of Wood Buffalo
 - 3. Mikisew Cree First Nation
- Alberta Sustainable Resource Development. "Alberta Forest Management Planning Standards." April 2006.
- Aon Consulting Ltd. "Northern Lights Health Region Human Resource Assessment." August 2006.
- Applications Management Consulting Ltd. "Imperial Oil Resource Ventures Ltd. – Kearl Oil Sands Project – Mine Development – Socio-Economic Impacts: Municipal Infrastructure – Final Report." October 2006.
- Archibald Gerald, PhD, Archibald Research and Planning. "Fort McMurray Quality of Life and Social Indicator Review; Submission in Support of Intervention of the Regional Municipality of Wood Buffalo; Application Nos. 1408771 and 1414891, Kearl Lake Oil Sands Project, Imperial Oil Resources Ventures Ltd." October 2006.
- Armin A. Preiksaitis & Associates Ltd. in association with Associated Engineering and Thurber. "Draft – Area Development and Growth Constraints – Assessment for the Fringe Area." November 2006.
- Aspen Regional Health. "Alberta Oil Sands Consultations." November 2006.
- Associated Engineering Alberta Ltd. "Fort McMurray Infrastructure Review Regional Municipality of Wood Buffalo Intervention – Imperial Oil Resources Ventures Ltd. – Kearl Oil Sands Project Application Nos. 1408771 & 1414891" October 2006.
- Athabasca Regional Issues Working Group Association. "Realizing the Vision – Presentation to the Oil Sands Ministerial Strategy Committee." September 2006.
- Athabasca Regional Issues Working Group Association. "Realizing the Vision - Presentation to the Standing Policy Committee on Energy & Sustainable Development." June 2006.
- Athabasca Regional Issues Working Group Association in conjunction with Regional Municipality of Wood Buffalo/Fort McMurray Public Schools/Fort McMurray Catholic Board of Education/Northland School Division/ Keyano College and Northern Lights Health Region. "Wood Buffalo Business Case 2005 – A Business Case for Government Investment in the Wood Buffalo Region's Infrastructure." March 2005.

Athabasca Regional Issues Working Group Association in conjunction with Regional Municipality of Wood Buffalo/Fort McMurray Public Schools/Fort McMurray Catholic Board of Education/Northland School Division/Keyano College and Northern Lights Health Region. "Wood Buffalo Business Case 2005 – Update & Progress Report." December 2005.

B.C. Ministry of Agriculture and Lands. "Respect for the Land: Dehcho Land Use Plan." May 2006.

B.C. Ministry of Agriculture and Lands. "Muskwa-Kechika Management Plan." May 2006.

Brown & Associates Planning Group. "Town of Peace River Growth Study." April 2006.

Brownlee, LLP, Barristers & Solicitors. "Submission of Intervention of Regional Municipality of Wood Buffalo – Joint Panel Hearing of Application Nos. 1408771 and 1414891 – Kearn Oil Sands Project, Imperial Oil Resources Ventures Limited." October 2006.

Campbell Ryder Consulting Group Ltd. "Rate Review and Analysis of the Regional Municipality of Wood Buffalo Water, Wastewater and Solid Waste Utilities." April 2006.

Campbell Ryder Consulting Group Ltd. "Regional Municipality of Wood Buffalo - Residential Water Service; Truck Fill Service – Water Rates; Residential Wastewater Service; Comparable Residential Solid Waste Rates." January 2006.

Canada West Foundation. "New Tools for New Times – A Sourcebook for the Financing, Funding and Delivery of Urban Infrastructure." September 2006.

Canada West Foundation. "Seizing Today and Tomorrow – An Investment Strategy for Alberta's Future." February 2006.

Canadian Association of Petroleum Producers. "Alberta's Oil and Gas Royalties – Q & A –how Alberta gains from higher prices." March 2006.

Canadian Association of Petroleum Producers. "Backgrounder: Oil Sands Economic Impacts Across Canada – CERl Report." September 2005.

Canadian Association of Petroleum Producers. "Bitumen Pricing Methodology for SEC Reserves Disclosure." September 2005.

Canadian Association of Petroleum Producers. "Canadian Oil and Natural Gas – Overview and Outlook." January 2006.

Canadian Association of Petroleum Producers. "Canadian Crude Oil Production and Supply Forecast 2006-2020." May 2006.

Canadian Association of Petroleum Producers. "The Canadian Oil Sands - Opportunities and Challenges." February 2006.

Canadian Centre for Energy Information. "Canada's Oil Sands." June 2006.

Canadian Energy Research Institute. "Economic Impacts of Alberta's Oil Resources." August 2006.

Canadian Energy Research Institute. "Economic Impacts of Alberta's Oil Sands." October 2005.

Canadian Energy Research Institute. "Economic Impacts of Oil Sands in the Short-Term (Impacts for the 2006-2011 Period)." December 2006.

Canadian Natural Resources Limited. "Corporate Presentation – The Premium Value, Defined Growth, Independent." August 2006.

Canadian Natural Resources Limited. "Horizon Construction Management Ltd. – Presentation to Alberta Oil Sands Multi-Stakeholder Committee Consultation Panel – Edmonton." September 2006.

Canadian Natural Resources Limited. "Presentation to Alberta Oil Sands Multi-Stakeholder Committee Consultation Panel – Bonnyville." September 2006.

Canadian Natural Resources Limited. "Presentation to Alberta Oil Sands Multi-Stakeholder Committee Consultation Panel – Fort McMurray." September 2006.

Canadian Parks and Wilderness Society/The Pembina Institute. "Death by a Thousands Cuts." August 2006.

City of Cold Lake. "Oil Sands Consultations." September 2006.

CP Ross Consulting Group Inc. "Alberta's Industrial Heartland Corridors for Linear Infrastructure Workshop." September 2006.

Cumulative Effects Management Association (CEMA)/Regional Aquatics Monitoring Program (RAMP)/The Wood Buffalo Environmental Association (WBEA). "Measuring Up: Reporting our Environmental Activities to the Community." 2006.

Cumulative Effects Management Association (CEMA). "Vision, Purpose and Structure." 2006.

Cumulative Effects Management Association (CEMA). "Summary Document – In Support of Muskeg River Mine Expansion Hearing." August 2006.

Construction Sector Council. "Working Mobile: A study of Labour Mobility in Canada's Industrial Construction Sector." 2005.

Construction Sector Council. "Construction Looking Forward – Labour Requirements form 2006 to 2014 for Alberta." May 2006.

Davis & Company LLP. "Submission of Intervention of the Northern Lights Health Region – Application No. 1398411." August 2006.

Deloitte Inc. "Verification of Industry Information Used by the Athabasca Regional Issues Working Group in the Wood Buffalo Business Case 2005." December 2006.

ECO Industrial Solutions. "Alberta Industrial Heartland Eco-Industrial Master Plan." May 2006.

Economic Development Advisory Committee – Opportunity Identification Group. "City of Cold Lake – Affordable Housing Report 2006." 2006.

EnCana Corporation. "News Release - EnCana and ConocoPhillips to create integrated North American heavy oil business." October 2006.

Fort McMurray Catholic School District. "Fort McMurray Catholic School District – Three-Year Education Plan 2006-2009.

Fort McMurray Chamber of Commerce. "Presentation to the Oil Sands Multi-Stakeholder Consultation Panel". September 2006.

Fort McMurray Public Schools/Fort McMurray Catholic Schools/Conseil scolaire Centre-Nord and Northland School Division No. 61." Cost of Living Proposal to Minister of Education." October 2006.

Gary Gordon and Associates. "Housing Overview and Outlook – Submission in Support of Intervention of Regional Municipality of Wood Buffalo in Application Nos. 1418771 and 1414891 – Kearn Project, Imperial Oil Resources Ventures Ltd." October 2006.

Health Quality Council of Alberta. "Satisfaction with Health Care Services: A Survey of Albertans 2006 - Executive Summary." September 2006.

Imperial Oil – ESSO. "Multi-Stakeholder Committee on Oil Sands Development." October 2006.

Imperial Oil – ESSO. "Planned Development in Area." 2006.

IPS Consulting Inc. "Socio-Economic Evaluation – Muskeg River Mine Expansion Project- Albian Sands Energy Inc.". August 2006.

Miller Thomson, LLP, Barristers & Solicitors. "Briefing Material for Northern Lights Health Region for the Alberta Energy & Utilities Board Hearings Respecting Imperial Oil's Kearn Lake Project." November 2006.

Miller Thomson, LLP, Barristers & Solicitors. "Submission of Intervention of The Northern Lights Health Region – Application Nos. 1408771 & 1414891." October 2006.

Municipal District of Bonnyville No. 87. "Presentation to Government of Alberta Oil Sands Committee." September 2006.

National Energy Board. "Canada's Oil Sands – Opportunities and challenges to 2015: An Update." June 2006.

Natural Resources Canada. "Canada's Energy Outlook: The Reference Case 2006." 2006.

Nichols Applied Management. "Final Report - Infrastructure Review – Regional Municipality of Wood Buffalo." November, 2006.

Nichols Applied Management. "Survey of Residents of Construction Camps in the Wood Buffalo Region." August 2003.

Nichols Applied Management. "Sustainable Community Indicators – Working Document." January 2006.

Nichols Applied Management. "Sustainable Community Indicators – Summary Report." January 2006.

Nichols Applied Management. "Final Report – Selected Oil Sands Industry Metrics pertaining to the Cold Lake, Peace River, and Alberta Industrial Heartland areas." November 2006.

Northern Lights Health Region. "Presentation to The Multi-Stakeholder Oil Sands Consultation Group: Oil Sands Relationship, Human Resource Challenges, Capacity and Infrastructure, Funding, Possible Solutions, and Conclusions." September 2006.

Northern Lights Health Region. "Presentation to The Multi-Stakeholder Oil Sands Consultation Group." September 2006.

Northern Lights Medical Staff Association. "Submission to Oil Sands Consultation Group Multi-stakeholder Committee." October 2006.

Northern Lights School Division No. 69 Political Advocacy Committee. "The Impact of Oil Sands Growth on Northern Lights School Division No. 69." October 2006.

Oil Sands Consultation Group. "Final Report and Recommendations." March 2006.

Petro-Canada. "Presentation to Multi-Stakeholder Committee, Government of Alberta." September 2006.

Regional Municipality of Wood Buffalo. "Census 2006." 2006.

Regional Municipality of Wood Buffalo. "2005 Municipal Censuses." 2006.

Regional Municipality of Wood Buffalo. "Impacts of Oilsands Development on the Quality-of-Life in Six Communities – Final Report." September 2006.

Regional Municipality of Wood Buffalo. "Population and Housing Projections for the Urban Service Area for 2006-2010." December 2005.

Regional Municipality of Wood Buffalo, "Report on Housing Needs in Fort McMurray", November, 2006

Regional Municipality of Wood Buffalo. "Standing Committee Report – Utility Rate Strategy." June 2006.

Regional Municipality of Wood Buffalo. "Submission of the Regional Municipality of Wood Buffalo to the Oil Sands Multi-Stakeholder Committee." September 2006.

Scenarios to Strategy Inc. "Hydrocarbon Upgrading Task Force (HUTF)." September 2006.

Scenarios to Strategy Inc. "Alberta Hydrocarbon Vision 2020." 2005.

Stantec. "Regional Pipeline Corridor and Setback Study." November 2004.

Suncor Energy Inc. "A Vision for Sustainable Development – Presentation to the Government of Alberta's Consultation Panel on Oil Sands Development ." September 2006.

Suncor Energy Inc. "Voyageur Upgrader – Socio-Economic Impact Assessment Summary." March 2005

Suncor Energy Inc. "Voyageur Binder No.1 – Index." July 2006.

- A. List of Interveners
- B. Government of Alberta Submissions
 1. June 19, 2006 Hearing Submission
 2. Supplemental Letter to Alberta's Evidence
 3. Appendices to Alberta's Hearing Submission
 4. Closing Submissions
- C. Other Submissions
 5. Wood Buffalo First Nation
 6. Clearwater River Paul Cree Band #175
 7. Athabasca Chipewyan First Nation
 8. Métis Local 1935, Métis Local 2020, Willow Lake Métis Local 780, Fort McKay Métis Local 63, Conklin Métis Local 193, Chard Métis Local 214, William Loutitt, Ronald Quintal

9. Fort McKay Industry Relations Corporation
10. Syncrude Canada Ltd.
11. Canadian Natural Resources Limited
12. Synenco Energy
13. Shell Canada
14. Imperial Oil
15. Mikisew Cree First Nation
16. MLA Boutilier
17. Northern Lights Health Region
18. Oil Sands Environmental Coalition
19. Regional Municipality of Wood Buffalo
 - i. Submission
 - ii. Preiksaitis Housing Report
 - iii. Howry Report
 - iv. McDougall Report

Syncrude Canada Ltd. "Securing Canada's Energy Future – Submission to the Oil Sands Multi-Stakeholder Consultation Panel – Edmonton." September 2006.

Syncrude Canada Ltd. "Securing Canada's Energy Future – Submission to the Oil Sands Multi-Stakeholder Consultation Panel – Fort McMurray." September 2006.

Tertzankian, Peter. "A Thousand Barrels a Second." 2006.

The Conference Board of Canada. "Canada's Oil and Gas Industry – Industry Outlook." Summer 2006.

The Pembina Institute. "Oil Sands Fever – The Environmental Implications of Canada's Oil Sands Rush." November 2005.

The Pembina Institute. "Thinking Like an Owner – Overhauling the Royalty and Tax Treatment of Alberta's Oil Sands." November 2006.

The Pembina Institute. "Troubled Waters, Troubling Trends – Technology and Policy Options to Reduce Water Use in Oil and Oil Sands Development in Alberta." May 2006.

Total E&P Canada Ltd. "Presentation to the Oil Sands Multi-Stakeholder Committee." September 2006.

Town of Bonnyville. "The Infrastructure Challenge." 2006.

United States Department of Energy. "World Oil Markets – Chapter 3." 2006.

University of Calgary – Robert Mansell & Ron Schlenker. "Energy and the Alberta Economy: Past and Future Impacts and Implications." October 2006.

Walker Hugh, Walker Economics Inc. "Pressures on the Northern Lights Health Region Arising from the Development of Alberta's Oil Sands." August 2006.

Wood Buffalo Housing Development Corporation. "Housing Strategy for the Future." September 2006.

Oil sands mining and reclamation cause massive loss of peatland and stored carbon

Rebecca C. Rooney, Suzanne E. Bayley, and David W. Schindler¹

Department of Biological Sciences, University of Alberta, Edmonton, AB, Canada T6G 2E9

Contributed by David W. Schindler, November 3, 2011 (sent for review August 30, 2011)

We quantified the wholesale transformation of the boreal landscape by open-pit oil sands mining in Alberta, Canada to evaluate its effect on carbon storage and sequestration. Contrary to claims made in the media, peatland destroyed by open-pit mining will not be restored. Current plans dictate its replacement with upland forest and tailings storage lakes, amounting to the destruction of over 29,500 ha of peatland habitat. Landscape changes caused by currently approved mines will release between 11.4 and 47.3 million metric tons of stored carbon and will reduce carbon sequestration potential by 5,734–7,241 metric tons C/y. These losses have not previously been quantified, and should be included with the already high estimates of carbon emissions from oil sands mining and bitumen upgrading. A fair evaluation of the costs and benefits of oil sands mining requires a rigorous assessment of impacts on natural capital and ecosystem services.

wetland reclamation | tar sands

An area larger than the state of Rhode Island will eventually be mined by oil sands companies in northern Alberta. These boreal lands must be reclaimed, but despite claims to the contrary (1), operators are not required to return the land to its original state (2). This study was precipitated by the disparity between statements made by the oil sands industry regarding the extent and anticipated success of mine reclamation and their official closure plans, which serve as agreements between mine operators and the Alberta government regarding actual reclamation expectations.

Oil sands deposits accessible by open-pit surface mining cover about 475,000 ha of boreal Alberta, 99% of which is already leased (3). Currently, 10 mines have government approval to operate, covering about 167,044 ha (Fig. 1). This is a conservative estimate that excludes the pipelines, roads, seismic lines, and other infrastructure that support the mines. It also excludes impacts from aerial deposition (4) and aquifer dewatering (5) that extend off-site and the area of land associated with the three additional mines currently undergoing environmental review.

Constraints imposed by the postmining landscape and the sensitivity of peatland vegetation prevent the restoration of peatlands that dominated the premining landscape. Mine proponents are required to describe the premining landscape and produce closure plans that detail the postmining landscape. Current reclamation regulations do not require the restoration of previous land covers or the restitution of lost carbon formerly stored in soils and vegetation. In place of destroyed peatlands, operators plan to construct upland forest with well-defined drainage channels and subsaline shallow open water wetlands draining into large tailings ponds capped with freshwater. The net effect of this landscape transformation on biodiversity and ecosystem functions has not been assessed. Here we quantify the land cover changes that will result from approved oil sands mine projects and their impact on carbon storage.

Pre- Versus Postmining Landscapes

The oil sands mining area was originally wetland-rich, covered in forested and shrubby fens. In 2002, Canadian Natural Resources Ltd. mapped vegetation cover types within a 2,277,376-ha area that encompasses the surface-mineable area (Fig. 1) (details in

ref. 6). They found that 64% of the land supported wetland vegetation, whereas only 23% of the land supported upland vegetation (Table 1). The most common land cover type was fen vegetation, whereas deep water, shallow open water, and marsh habitat were scarce (Table 1). Due to the heterogeneous distribution of wetlands in the region, the exact proportion of wetland habitat differs among the 10 approved mining projects (Table 2). Generally, the east bank of the Athabasca River supports more wetland habitat than the drier west bank (Fig. 1 and Table 2).

Despite efforts to standardize industry reporting (*SI Text*), many inconsistencies remain that impede assessment of cumulative effects and direct comparison between pre- and postmining landscapes. For example, the taxonomic and spatial resolutions used to make predictions about the postmining landscape are coarser than those detailing baseline conditions, mainly due to difficulty in predicting drainage and nutrient conditions.

A direct comparison of pre- and postmining landscapes is only possible for 4 of the 10 approved mines: The Horizon, Jackpine-Phase 1, Muskeg, and Kearl mine closure plans provided the relative abundance of pre- and postmining vegetation cover (7–10) (Table 3 and Table S1). These four mines represent only 42% of the area approved for mining, although they are representative in their distribution: 59% on the wetter east bank and 41% on the drier west bank, compared with 61% and 39% of the total leased area approved for mining on the east and west banks, respectively. Suncor Energy Inc. and Syncrude Canada Inc. did not provide data on the relative abundance of vegetation covers for the six mines they operate, but did provide figures contrasting the pre- and postmining landscapes (e.g., Fig. 1 and Fig. S1). Thus, although we cannot quantify changes to land cover across the entire region, we can make generalizations about vegetation changes with confidence that they apply to all mines.

The most striking change to result from reclamation will be the conversion of wetland habitat to upland forest. According to company closure plans, uplands will increase by 15,030 ha on the leaseholds of the four mines, mainly at the expense of peatlands, which will decrease by 12,414 ha (67% of their premining coverage). Wetlands in general will decrease by 11,761 ha, with the loss of peatlands slightly offset by the creation of marsh and riparian shrublands (Table 3). Operators will create end-pit lakes by capping tailings ponds with freshwater (*SI Text*), boosting the amount of deep water and littoral habitat (Table 3). End-pit lakes will be fed by extensive drainage networks (e.g., Fig. 1) that may support riparian habitat (Table 3). Scaling up, assuming similar land conversion ratios for the additional six mines, about 29,555 ha of peatlands will be lost as a result of currently approved mining (net wetland loss = 28,002 ha).

Author contributions: R.C.R. designed research; R.C.R. performed research; R.C.R. contributed new reagents/analytic tools; R.C.R. analyzed data; and R.C.R., S.E.B., and D.W.S. wrote the paper.

The authors declare no conflict of interest.

Freely available online through the PNAS open access option.

¹To whom correspondence should be addressed. E-mail: d.schindler@ualberta.ca.

This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1117693108/-DCSupplemental.

Table 1. Vegetation cover within and surrounding the surface mineable oil sands area.

Land cover class	Total area (ha)	Regional study area (%)
Terrestrial vegetation		
Coniferous	25,309	1
Deciduous	273,050	12
Mixedwood	217,990	10
Terrestrial vegetation subtotal	516,349	23
Water		
Deep water (>2 m)	13,352	1
Shallow open water (<2 m)	27,728	1
Water subtotal	41,080	2
Wetlands		
Graminoid fen	61,395	3
Marsh	41,320	2
Poor wooded fen/wooded bog	187,349	8
Shrubby fen	231,109	10
Wooded fen	923,895	41
Wetlands subtotal	1,445,068	64
Other		
Burn (within 20 y)	144,227	6
Cloud	25	<1
Cutblocks	57,648	3
Disturbances	63,492	3
Shrubland	8,619	<1
Urban/industrial	868	<1
Other subtotal	274,879	12
Total	2,277,376	100

Data are adapted from table B3-2 in Raine et al. (6).

In terms of the vegetation, reclamation will mean the replacement of low-productivity tamarack (*Larix laricina*) and black spruce (*Picea mariana*) fens and bogs with higher-productivity forests of white spruce (*Picea glauca*), jack pine (*Pinus banksiana*), and trembling aspen (*Populus tremuloides*). Understorey vegetation will change from sedges, ericaceous plants such as labrador tea (*Ledum groenlandicum*), and mosses such as *Sphagnum* spp. and *Drepanocladus* spp. (which can deposit up to several meters of peat) to blueberry (*Vaccinium myrtilloides*), dogwood (*Cornus* spp.), and low-bush cranberry (*Viburnum edule*) (which accumulate much less carbon in the soil). Reclamation will also mean a shift in age structure, as reclaimed forests will begin as seedlings and will take 50–70 y to reach harvestable age (11). The shift to a drier forest will also mean a change in fire regime, as drier forest types are more susceptible to fire (12) and thus support younger stands than wetter forests on average.

Impediments to Wetland Restoration

There are several reasons closure plans favor the creation of well-drained habitat over wetlands (e.g., 8, 11). First, Alberta has no wetland policy requiring compensation for wetland loss in the boreal region. Second, because the volume of tailings and upgrading by-products exceeds the size of mine pits, the closure landscapes will consist of hills instead of the level topography that dominated the region before mining. Thus, wetlands will be restricted to the depressions between hills and surrounding end-pit lakes (e.g., Fig. 1, *Inset*). Third, to foster geotechnical stability, the closure landscapes are channelized to drain quickly (e.g., Fig. 1, *Inset*). Creating wetland habitat that slows the flow of water can result in soil saturation, gully formation, and landform collapse (13). Fourth, end-pit lakes are designed to remediate tailings water (*SI Text*), and extensive wetlands would increase the evaporative surface area of the closure landscape, reducing end-pit lake function. Given that precipitation is less than potential evapotranspiration in the oil sands-mineable area, water availability will limit wetland area in the reclaimed landscape.

No closure plan calls for the restoration of lost peatlands (7–9, 11, 14). Cattails and other marsh plants may tolerate the salt, metals, and naphthenic acids present in groundwater and surface runoff in reclaimed areas (15), but peatland vegetation is very sensitive to high conductivity and ion concentrations (16). Two pilot fen construction projects are under way to study survival of fen species in a tailings-contaminated environment and the capacity of reclamation materials to support fen-type hydrology. Recreating fen-type hydrology in the postmining landscape is possible, but requires a minimum 2:1 upland to peatland ratio for uplands to supply adequate seepage to maintain peat wetness (17). Thus, even if the entire closure landscape were designed to maximize fen habitat, it could not recreate the area of fens that was lost. Other considerations, such as the need for end-pit lakes and the limited availability of suitable substrate and vegetation (e.g., pilot fens were constructed by transfer of live peat from natural fens), ensure that constructed fens will only constitute a small fraction of the postmining landscape.

Implications

No large-scale oil sands reclamation project has undergone independent evaluation, and thus the ultimate success of closure plans remains uncertain (18). Upland habitat has been created (e.g., the 104 ha of Syncrude's Gateway Hill certified as reclaimed in 2008, representing 0.15% of land reported as disturbed by industry), but efforts to create marsh and shallow open water wetlands are less successful at restoring biological integrity (19, 20). Even if the goals outlined in closure plans are achieved, peatland loss will occur with substantial impacts to ecosystem services, including carbon storage.

Oil sands mining is frequently criticized as a carbon-intensive means of acquiring oil. Its contribution to the global carbon imbalance has provoked numerous calls to slow oil sands development, including, most recently, a letter to Canada's prime minister signed by eight Nobel Peace Laureates. Greenhouse gas emissions from mining and upgrading oil sands bitumen are

Table 2. Summary of baseline vegetation cover within the development (DA) or local study areas (LSA) of mines with approval to operate granted by March, 2011

	Mildred		Suncor Basemine	Muskeg and expansion	Jackpine mine–phase 1		Suncor Steepbank and Millenium mines		Aurora
	Horizon mine	Lake and expansion			Kearl mine	Fort Hills mine	North mine		
Units	West ha in LSA	West ha in LSA	West ha in LSA	West ha in LSA	East ha in DA	East ha in LSA	East ha in DA	East ha in DA	East ha in LSA
Terrestrial vegetation	17,040	14,662	16,745	2,775	4,408	15,416	2,806	3,350	17,733
Peatlands	5,355	1,870	16,813	3,075	1	9,986	6,422	751	19,714
Riparian communities	2,600	708	0	1,216	1,434	7,804	100	1,012	199
Graminoid marsh	318	0	0	36	523	1	19	6	435
Shallow open water	332	175	61	61	21	42	8	0	249
Wetlands subtotal	8,605	2,753	16,874	4,388	1,979	17,833	6,549	1,769	20,597
Lakes and rivers	267	175	61	43	1,359	561	0	0	580
Disturbed land	1,874	909	1,300	5,270	38	206	0	419	1,197
Total	27,786	18,499	34,980	12,476	7,784	34,016	9,355	5,538	40,107
% wetland	31	15	48	35	25	52	70	32	51
% terrestrial	61	79	48	22	57	45	30	60	44

The west bank is typically drier and supports more upland habitat relative to the east bank, which supports more wetland habitat. As a part of their environmental impact assessments (EIAs), mine operators designate DAs, which represent the footprint of all facilities directly associated with mining, i.e., mine pits, tailings storage, bitumen recovery plants, etc., and LSAs, which include both the DA and a buffer around the DA that is intended to accommodate any potential indirect effects of the proposed development. Baseline conditions are typically presented for either the DA or LSA, but not for both. The vegetation cover values were obtained through a review of baseline studies in EIAs and the most recently updated reclamation, conservation, and closure plans (see *SI Text* for references).

estimated at between 62 and 164 kg CO₂ equivalents per barrel of oil produced, two to three times more than emissions from conventional oil production (21). With daily production of mined bitumen exceeding 1,142,000 barrels in 2010 (22), emissions add up quickly (>70,000 t CO₂/d) and hundreds of millions of dollars are being invested in reducing and capturing CO₂ (23). These tallies, however, completely neglect the carbon emissions resulting from peatland loss, yet our analysis suggests that carbon storage loss caused by peatland conversion could be equivalent to 7-y worth of carbon emissions by mining and upgrading (at 2010 levels).

The boreal forest is the world's largest and most important forest carbon storehouse (24), but its continued storage depends on future land management practices (*SI Text*). Based on extensive work in the Mackenzie River Basin, the range in peatland carbon storage is estimated at 530–1,650 metric tons (t) C/ha (25), equivalent to 1,943–6,050 t CO₂/ha. The breadth of this range reflects uncertainties associated with variability in peat depth, composition, and bulk density. Unfortunately, this information is not available from baseline studies, and we therefore chose to be conservative and represent the effects of this uncertainty on the range of C values. Reclamation prescriptions for postmining soils

Table 3. Net change in land cover types to result from oil sands mining reclamation based on baseline reports and closure plans for the Horizon, Jackpine–Phase 1, Kearl, and Muskeg mines

Description	Total pre (ha)	Total post (ha)	Net change	
			(ha)	(%)
Upland forest	39,114	54,587	15,473	40
Meadow	1	0	-1	-100
Shrubland	524	82	-442	-84
Bog	5,179	1,320	-3,859	-75
Fen	13,238	4,683	-8,555	-65
Graminoid marsh	878	2,595	1,717	196
Swamp	13,054	9,795	-3,259	-25
Shallow open water	456	94	-362	-79
Lake	2,059	5,702	3,643	177
River	171	152	-19	-11
Riparian shrubland	1	2,327	2,326	232,600
Littoral zone	0	230	230	Infinite
Clearcut	730	98	-632	-87
Disturbance	6,658	395	-6,263	-94
Peatland subtotal (bog and fen)	18,417	6,003	-12,414	-67
Wetland subtotal (peatland, graminoid marsh, swamp, shallow open water, riparian shrubland, and littoral zone)	32,806	21,045	-11,761	-36
Total	82,060	82,060	0	0

This constitutes 42% of the total area approved for mining as of March 2011, but is a representative sample of the region in terms of east and west bank distribution.

contain much less carbon: between 50 and 146 t C/ha (26). Thus, the replacement of 12,414 ha of peatlands with reclaimed soils will result in the loss of 4.8–19.9 million t of stored carbon. Based on the carbon value estimated by the Intergovernmental Panel on Climate Change at \$52/t of carbon sequestered (27), this equates to a \$248 million to \$1 billion loss of natural capital, yet we have only considered 42% of the area currently approved for mining. Scaling up, as we did with land cover, a loss of between 11.4 and 47.3 million t of stored carbon (between \$590 million and \$2.5 billion of carbon storage capital) will occur. Converting from units of carbon to CO₂ equivalents, this is between 41.8 and 173.4 t of CO₂ lost, as much as 7-y worth of mining and upgrading emissions at 2010 production levels.

Peatland loss will also influence the region's potential to sequester carbon in the future. Vitt et al. (28) estimated that western continental peatlands sequester 19.4 g C/m² of peatland/y. Accounting for forest fires, Turetsky et al. (29) suggest that the true rate of carbon sequestration is 24.5 g C/m² of peatland/y. Thus, the loss of 12,414 ha of peatland translates into 2,408–3,041 t of annual carbon sequestration potential. Scaling up, as with carbon storage, this equates to 5,734–7,241 t C/y (21,025–26,550 t CO₂/y) lost due to approved mines. The reclaimed landscape will sequester carbon at a much lower rate (28), determined by complex interactions between plant species (and the chemical composition of their litter), climate, soils, management, and the fire regime (30). Looking at Imperial Oil's Kearl Lake mine, Welham found that the vast majority of carbon sequestered in the reclaimed landscape was derived from peat amendments made to the soil during the first stages of reclamation (31). Given that the peat used in these amendments is obtained by stripping and stockpiling peat from adjacent land in preparation for mining, this fraction is actually residual storage from historical

peatlands, not newly sequestered carbon. Additionally, Turcotte's study of soil organic matter in reclaimed land on oil sands mine leases has demonstrated unexpectedly rapid decomposition of the peat in soil amendments, even the relatively recalcitrant lignin phenols (32). This suggests that conversion of peatlands to uplands with peat soil amendments transforms a relatively permanent carbon storage pool (historical peatlands) to a temporary one that leaks carbon rather than sequesters it. This is supported by Welham's model, which predicts that reclaimed forests will require 15 y of growth before carbon sequestration by vegetation begins to exceed the carbon emissions from decomposing peat amendments, suggesting that for years following mining and reclamation, reclaimed land will be a net carbon source (31).

Conclusion

Claims by industry that they will “return the land we use - including reclaiming tailings ponds - to a sustainable landscape that is equal to or better than how we found it” (33) and that it “will be replanted with the same trees and plants and formed into habitat for the same species” (34) are clearly greenwashing. The postmining landscape will support >65% less peatland. One consequence of this transformation is a dramatic loss of carbon storage and sequestration potential, the cost of which has not been factored into land-use decisions. To fairly evaluate the costs and benefits of oil sands mining in Alberta, impacts on natural capital and ecosystem services must be rigorously assessed.

ACKNOWLEDGMENTS. We thank Tanya Richens and John Keeler for assistance collecting data; Maria Strack for recommending carbon storage studies; and Suncor Energy Inc. for permission to reprint the *Inset* of Fig. 1. Funding was provided by Killam Trusts and Alberta Innovates Technology Futures in the form of scholarships to R.C.R.

- Hoag H (2010) Impacts of Canada's oil sands operations “exaggerated.” *NATNEWS*, 10.1038/news.2010.676.
- Government of Alberta (2010) *Reclamation*. <http://www.oilsands.alberta.ca/reclamation.html>.
- Government of Alberta (2010) *Alberta's Leased Oil Sands Area*. <http://www.energy.alberta.ca/LandAccess/pdfs/OSAagreesStats.pdf>.
- Kelly EN, et al. (2010) Oil sands development contributes elements toxic at low concentrations to the Athabasca River and its tributaries. *Proc Natl Acad Sci USA* 107: 16178–16183.
- Hackbarth DA (1980) Regional aquifer parameters evaluated during mine depressurization in the Athabasca Oil Sands, Alberta. *Can Geotech J* 17:131–136.
- Raine M, Mackenzie I, Gilchrist I (2002) CNRL Horizon Project environmental impact assessment. Vol 6 Appendix B. *Terrestrial Vegetation, Wetlands and Forest Resources Baseline* (Golder Associates, Calgary, AB), Report no. 012-2220.
- Imperial (2006) *Kearl Oil Sands Project Environmental Impact Assessment* (Imperial Oil Resources Ventures Ltd. and ExxonMobil Properties, Calgary, AB), Report no. WW0185.
- Shell (2007) *Jackpine Mine Expansion and Pierre River Mine Project* (Shell Canada Ltd., Calgary, AB).
- Canadian National Resources Ltd. (2006) *Horizon Oil Sands Project Life of Mine Closure Plan* (Canadian National Resources Ltd., Calgary, AB).
- Shell (2005) *Application for the Approval of the Muskeg River Mine Expansion Project* (Shell Canada Ltd., Calgary, AB).
- Suncor (2010) *Supplemental Information Request—Suncor Tailings Reduction Operations Energy Resources Conservation Board* (Suncor Energy, Calgary, AB), Application no. 1626702, Alberta Environment Application no. 56-94, Round 1, Suncor 2009, p 172.
- Larsen CPS (1997) Spatial and temporal variations in boreal forest fire frequency in northern Alberta. *J Biogeogr* 24:1027–1057.
- Harris ML (2007) *Guideline for Wetland Establishment on Reclaimed Oil Sands Leases* (Lorax Environmental for CEMA Wetlands and Aquatics Subgroup of the Reclamation Working Group, Fort McMurray, AB).
- Syncrude (2006) *Application for Renewal of Approvals* (Syncrude Canada Ltd., Calgary, AB).
- Rooney RC, Bayley SE (2011) Setting reclamation targets and evaluating progress: Submersed aquatic vegetation in natural and post-oil sands mining wetlands in Alberta, Canada. *Ecol Eng* 37:569–579.
- Vitt DH, Chee W-L (1990) The relationships of vegetation to surface water chemistry and peat chemistry in fens of Alberta, Canada. *Plant Ecol* 89:87–106.
- Price JS, McLaren RG, Rudolph DL (2009) Landscape restoration after oil sands mining: Conceptual design and hydrological modelling for fen reconstruction. *Int J Min Reclam Environ* 24:109–123.
- Grant J, Woyonilowicz D, Dyer S (2008) *Fact or Fiction: Oil Sands Reclamation* (Pembina Inst, Edmonton, AB).
- Rooney RC, Bayley SE (2010) Quantifying a stress gradient: An objective approach to variable selection, standardization and weighting in ecosystem assessment. *Ecol Indic* 10:1174–1183.
- Rooney RC, Bayley SE (2011) Development and testing of an index of biotic integrity based on submersed and floating vegetation and its application to assess reclamation wetlands in Alberta's oil sands area, Canada. *Environ Monit Assess*, 10.1007/s10661-011-1999-5.
- Charpentier AD, Bergerson JA, MacLean H (2009) Understanding the Canadian oil sands industry's greenhouse gas emissions. *Environ Res Lett* 4:014005.
- Energy Resources Conservation Board (2011) *Alberta's Energy Reserves 2010 and Supply/Demand Outlook 2011–2020* (Energy Resources Conservation Board, Calgary, AB), Report no. ST98-2011.
- Government of Alberta (2011) *Clean Energy Project Agreement in Place*. <http://alberta.ca/acn/201107/309936C704039-C791-2E11-450AA4194BD5C4C0.html>.
- Anielski M, Wilson S (2010) *Real Wealth of the McKenzie Region: Assessing the Natural Capital Values of a Northern Boreal Ecosystem* (Canadian Boreal Initiative, Ottawa, ON).
- Beilman DW, Vitt DH, Bhatti JS, Forest S (2008) Peat carbon stocks in the southern Mackenzie River Basin: Uncertainties revealed in a high-resolution case study. *Glob Change Biol* 14:1221–1232.
- Cumulative Effects Management Association (2010) *Results from Long Term Soil and Vegetation Plots Established in the Oil Sands Region (2009): Soils Component* (Paragon Soil and Environmental Consulting, Edmonton, AB).
- Intergovernmental Panel on Climate Change (2007) *Summary for Policymakers* (Intergovernmental Panel on Climate Change, Cambridge, UK), pp 7–22.
- Vitt DH, Halsey LA, Bauer IE, Campbell C (2000) Spatial and temporal trends in carbon storage of peatlands of continental Western Canada through the Holocene. *Can J Earth Sci* 37:683–693.
- Turetsky MR, Wieder RK, Halsey LA, Vitt DH (2002) Current disturbance and the diminishing peatland carbon sink. *Geophys Res Lett* 29:21–24.
- Lal R (2005) Forest soils and carbon sequestration. *For Ecol Manage* 220:242–258.
- Welham C (2010) Simulating the carbon balance in reclaimed forest ecosystems with the FORECAST model. *Proceedings of Reclamation and Restoration of Boreal Peatland and Forest Ecosystems: Toward a Sustainable Future, 25–27 March 2010, Edmonton, AB*. <http://www.peatnet.siu.edu/Assets/presentations/Welham.pdf>.
- Turcotte I (2009) Soil organic matter quality in northern Alberta's oil sands reclamation area. MSc thesis (University of Alberta, Edmonton, AB).
- Canadian Association of Petroleum Producers (2011) *Land—Technology and Innovation*. <http://www.capp.ca/energySupply/innovationStories/land/Pages/default.aspx#W0rMweeqm9>.
- Burton B (February 20, 2010) Tapping into a prehistoric beach. *National Post*. Available at <http://www.nationalpost.com/news/story.html?id=2590054>, but can still be accessed online here http://www-static.shell.com/static/can-en/downloads/media/2010/heavy_oil_series_jan_martindale.pdf.