Review of Shell Canada's Jackpine Mine Expansion & Pierre River Mine Project Application

Prepared for

Mikisew Cree First Nation IRC

July 2009

Prepared by

207 Edgebrook Close NW
Calgary, Alberta
T3A 4W5 Canada
Phone (403) 241-8668
Fax (403) 241-8679
Email: petr.komers@mses.ca

List of Contributors

Project Management	Dr. Sheri Gutsell
Senior Review	Dr. Petr Komers, P.Biol. and Dr. Sheri Gutsell
Hydrogeology	Mr. Owen Quinn, M.Sc., P. Geo and Mr. John Balfour, M.Sc., P.Eng.
Hydrology	Dr. Stefan Kienzle
Air Quality	Dr. Kevin McCullum, P.Eng.
Water Quality	Dr. Michael Vander Meulen
Fisheries	Mr. Tom Boag, M.Sc.
Aquatic Health	Dr. Bruce Barton
Vegetation	Dr. Elizabeth Dickson, P.Biol. and Dr. Sheri Gutsell
Biodiversity	Dr. Elizabeth Dickson, P.Biol.
Wildlife & Regulatory Setting	Dr. Troy Whidden, P.Biol.
Reclamation	Dr. Sheri Gutsell
Monitoring & Follow Up Programs	Dr. Petr Komers, P.Biol.
Regional Change Analysis	Mr. Zoran Stanojevic, M.F.
Socio-economic & TEK	Dr. Jim Tanner
Public Consultation & TEK	Dr. Kashif Sheikh, P.Biol.
Integration & Report Writing	Ms. Shannon Gavin, M.Sc., P.Biol. and Dr. Petr Komers, P.Biol.

Acronyms/Abbreviations

AAAQO	Alberta Ambient Air Quality Objectives
AENV	Alberta Environment
AGCC	Alberta Ground Cover Classification
ASRD	Alberta Sustainable Resource Development
AVI	Alberta Vegetation Inventory
BACT	Best Available Control Technology
BATEA	Best Available Technology Economically Achievable
bbl/cd	Abbreviation for barrels per calendar day
C&R	Conservation and Reclamation
CBM	Community-based Monitoring
CEA	Cumulative Effects Analysis
CEMA	Cumulative Environmental Management Association
DFO	Fisheries and Oceans Canada
EIA	Environmental Impact Assessment
EPEA	Environmental Protection and Enhancement Act
EPL	End Pit Lakes
ERCA	Energy Resources Conservation Act
ESA	Environmental Significant Area
ESR	Environmental Setting Report
ETDA	External Tailings Disposal Area
FN	First Nations
GHGs	Greenhouse Gases
GoA	Government of Alberta
H_2S	Hydrogen sulphide
ha	hectares
HSI	Habitat Suitability Index
HSPF	Hydrological Simulation Program-Fortran
JEMA	EIA refers to Jackpine Mine Expansion as Jackpine Expansion Mining Area
KIR	Key Indicator Resource

LSA	Local Study Area
MFT	Mixed Fine Tailings
MSES	Management and Solutions in Environmental Science
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
OSCA	Oil Sands Conservation Act
PAH	Polycyclic Aromatic Hydrocarbons
PAI	Potential Acid Input
$PM_{2.5}$	Particulate Matter
PMF	Probable Maximum Flood
PRMA	EIA refers to Pierre River Mine as Pierre River Mining Area
RAMP	Regional Aquatics Monitoring Program
RSA	Regional Study Area
RSF	Resource Selection Function
SO_2	Sulphur Dioxide
SOPC	Substances Of Potential Concern
t/d	tonnes per day
TDS	Total Dissolved Solids
TEK	Traditional Ecological Knowledge
TES	Terrestrial Environmental Setting
TESL	Texas Effects Screening Level
THC	Total hydrocarbon quality
TLU	Traditional Land Use
ToR	Terms of Reference
TR	Traditional Resources
VOCs	Volatile Organic Compounds
WBEA	Wood Buffalo Environmental Association
WET	Whole effluent toxicity

Executive Summary

The Mikisew Cree First Nation GRC (Mikisew Cree) has requested that Management and Solutions in Environmental Science (MSES) review Shell Canada's (Shell) Environmental Impact Assessment (EIA) for the Jackpine Mine Expansion (JEMA) and Pierre River Mine (PRMA) Oil Sand Projects. The package to be reviewed is a single submission of two separate applications for approval: one for an amendment to expand the approved Jackpine – Phase 1 and one for approval for construction, operation and closure of the PRMA. Our review will evaluate the Application that has been prepared to assess the combined effects of the two projects, including the associated baseline data and the approach to impact prediction.

While examining the EIA we are mindful that a great concern of the Mikisew Cree is the impact of the projects upon their Treaty Rights. We are advised by the Mikisew Cree that those rights include the right to carry on traditional resource based activities within their traditional territory of which the LSA and RSA are a part.

MSES evaluated the application to determine how and to what extent Shell has addressed the concerns of the Mikisew Cree surrounding environmental stewardship and to provide recommendations to Shell as to how these concerns and issues could be incorporated into the application and environmental management process. The review focused on the following disciplines: traditional knowledge, public consultation and socio-economics, wildlife, vegetation, biodiversity, hydrogeology, hydrology, water quality, fisheries, aquatic health, air quality, monitoring & follow-up, reclamation, regulatory settings and cumulative effects. Discipline reviewers have identified the following key findings as being shortcomings of the Application or points that require further clarification. Associated rationale and additional potential issues of concern are presented in the body of this report.

Key Finding (Traditional Ecological Knowledge and Public Consultation)
The consultation process does not involve a discussion of the concerns raised by the Mikisew Cree and there is no information on the content of the meetings or if any agreements were made and follow up plans discussed. There is no evidence that the issues relating to the protection of Treaty Rights have been resolved. Traditional Ecological Knowledge (TEK) was not used to conduct an assessment of impacts on the practice of Treaty Rights. There is no discussion of involving the Mikisew Cree in any design of the impact assessment or of project design, operations and monitoring.

Key Finding (Traditional Land Use and Socio-economics)
The methods used to measure the socio-economic impact of the Projects on the Mikisew Cree are unscientific and based upon misunderstandings. The EIA did not assess the likely adverse impacts on the

socio-economic conditions of the Mikisew Cree. The lack of planning for and accommodation of the socioeconomic requirements of First Nations (FNs) may threaten their Treaty Rights.

Key Finding (Wildlife)

The sampling and analytical procedures do not allow for a quantification and objective understanding of current conditions that are required to define the success of re-establishing wildlife resources. Site-specific mitigation plans are required, but are not apparent. There is no explicit link between the assessment of effects on wildlife and the resulting effects on Traditional Resource Use. Shell has not demonstrated that regional planning for wildlife is being done and that it works.

Key Finding (Vegetation)

Some aspects of the baseline data may not be adequate to properly understand pre-disturbance conditions. This is problematic for impact predictions, particularly relating to wetlands and burns. The classification of some areas as "burn" indicates a misunderstanding of boreal forest dynamics. There is a lack of accuracy assessment of vegetation data sources used for mapping. There is a lack of specific details, including targets, in the monitoring program.

Key Finding (Biodiversity)

No baseline information was gathered on genetic diversity for plant species. The results of the species diversity assessment are too general. Moreover, the calculations of biodiversity potential and the understanding of changes in landscape metrics make it impossible to interpret the significance of changes to species diversity and ecological functions. The biodiversity analyses are not useful foundations for impact predictions or benchmarks for monitoring biodiversity.

Key Finding (Hydrogeology)

The approach taken by the EIA did not involve regional and cumulative classification of hydrogeological impacts; this is not consistent with the EIA Terms of Reference (ToR). No solute transport modeling of regional groundwater flow was carried out to assess cumulative effects of the Project on regional groundwater quality. The peak impacts of degraded groundwater quality discharging to surface water systems potentially affecting Traditional Resources (TR) in the LSAs were not determined.

Key Finding (Hydrology)

Justification of predicted impacts is possibly misconstrued because it is based on data from watersheds with different characteristics. Declining trends of streamflow in the Athabasca River are dismissed in the impact predictions. An oil spill dispersion study was not carried out. The assumption that reconstructed soils and vegetation are identical to baseline watershed conditions was never demonstrated and is likely wrong. Mikisew Cree concerns about water have not been addressed.

Key Finding (Water Quality)

Impact predictions are based on overstatements of some results, vague characterization of confidence in predictions, and unhelpful appeal to conservative assumptions and linkage analyses. References to monitoring are dominated by existing programs, but some parameters measured in 2007 in the Muskeg River Mine exceed guidelines. There are assumptions, but no demonstration that viable biological processes will be established. Given the unconvincing predictions and past monitoring results, the assurance that adverse effects will be alleviated is questionable.

Key Finding (Fisheries)

Currently methods proposed and applied are insufficient to demonstrate success in meeting the mandate to restore aquatic resources as required by the *Fisheries Act*. The compensation lake proposed under the No Net Loss program, will replace existing lotic habitat with an artificial lentic habitat. The Mikisew Cree concern about the cumulative effects of water withdrawal on fish, combined with declining flow anticipated cumulatively in the river has not been addressed.

Key Finding (Aquatic Health)

Both projects have the potential for significant effects on aquatic resources in the region because of their proximity to major watercourse systems. The level of sampling for the baseline data to establish benchmark data on fish tissue quality was inadequate. The EIA does not consider other non-lethal end-points that may have profound effects on fish communities. The monitoring program does not include a component to monitor fish health. The reliance on regional monitoring plans (e.g., RAMP) to address cumulative effects is insufficient to protect Treaty Rights.

Key Finding (Air Quality)

It appears that ambient monitoring trends from Provincial stations show increasing trends in several compounds that could potentially exceed AAAQO levels for the region. It is unclear if the use of ashphaltene as a fuel has been tested and used elsewhere, whether any direct emission testing has been done or what the emissions look like. Discussions on greenhouse gas management are lacking, as are discussions of contingency plans or mitigation of an increasing trend in odours.

Key Finding (Monitoring and Follow-Up Programs)

The input provided by the Mikisew Cree to date is not meaningfully integrated in any part of the approval process. Consequently, the Mikisew Cree has not been allowed to contribute to the process of designing the operational, environmental and reclamation plans of the two projects. Neither the Approval 20809-01-00 nor the Monitoring programs and reports submitted thus far provide the necessary detail to evaluate the effectiveness of mitigating the impacts on TLU.

Key Finding (Reclamation)

The goal of re-establishing "equivalent land capability" is too vague to understand how TR will be re-established. Areas of traditional plant potential were only indirectly included in reclamation planning. Only a small number of species will be planted, and only a few ecosites are planned for the reclamation landscape. It is not stated how these species and ecosites will serve to protect the practice of Treaty Rights. It is an unsupported assumption that many plant species will establish naturally into reclaimed areas over time through successional processes.

Key Finding (Regulatory Setting & Cumulative Effects)

Shell provides no rationale for the unprecedented combining of two entirely disjointed projects under one application. The short time between the finalization of the ToR and the submission of the current application raises doubt that the opportunity actually existed to accommodate Mikisew Cree comments. No consideration of pre-disturbance conditions (pre-1965) is apparent. Shell provides a series of conceptual reclamation scenarios, but without demonstrating past successes of these scenarios there is no solid foundation to predict future success.

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS (cont)

PAGE

LIST OF FIGURES

LIST OF APPENDICES

1.0 Introduction

The Mikisew Cree First Nation GRC (Mikisew Cree) has requested that Management and Solutions in Environmental Science (MSES) review Shell Canada's (Shell) Environmental Impact Assessment (EIA) for the Jackpine Mine Expansion (JEMA) and Pierre River Mine (PRMA) Oil Sand Projects. The package to be reviewed is a single submission of two separate applications for approval: one for an amendment to expand the approved Jackpine Mine – Phase 1 and one for approval for construction, operation and closure of the PRMA. MSES understands that maintaining the traditional resource use and cultural activities is importance to the Mikisew Cree and that a proposed project must not affect their rights protected by Treaty 8 (we also refer to these rights as Treaty Rights). In our review, we therefore ask how the presented information can be used by the Proponent to develop mitigation measures and how the effectiveness of the mitigation can be measured to demonstrate the success of achieving the targets of returning traditional resources (TR) to their original state.

MSES reviewed the Application with that concern in mind and related it to the rigor and relevance of the proposed environmental management plans. In its evaluative approach, MSES maintains that it is essential that scientific rigor be employed when considering the potential impacts of oil sands projects and in determining the potential success of reclaiming the land for future generations. Shell's existing and proposed follow-up programs were evaluated in terms of their credibility to achieve the land use targets of importance to the Mikisew Cree. Moreover, from a regulatory setting point of view we evaluated the findings in the EIA in terms of how they may be used to satisfy regulatory terms and conditions of potential approvals, this in light of already existing approvals for Shell's current operations. Below we present reviewers' comments on project design and their evaluations of the proposed predicted impacts of the project in light of the plausible environmental management and restoration plans.

1.1 Project Description

Shell has prepared one EIA covering impacts associated with both projects. The purpose of the current EIA is to assess the potential impacts of these mining projects on humans and the natural resources of the Athabasca River area.

Shell is applying for an amendment to the Jackpine Mine-Phase 1 approvals to increase bitumen production by 100, 000 bbl/cd which would increase the bitumen production capacity to 300,000 bbl/cd. JEMA will be located adjacent to the currently approved Jackpine Mine-Phase 1, approximately 70 km north of Fort McMurray, Alberta, within Townships 95, 96, and 97 and Ranges 9 and 8 W4M on the east side of the Athabasca River (Figure 1-1). The expansion will include additional mining areas and associated processing facilities, utilities, and infrastructure.

Shell is applying for an approval to create and operate a new mining area, PRMA, which will produce up to 200,000 bbl/cd of bitumen. The PRMA will be located on the west side of the Athabasca River and will include a new mining area, associated processing facilities, utilities, and infrastructure (Figure 1-1). The eastern limits of the PRMA extend to less than 1 km from the Athabasca River.

1.2 Review Approach and Report Structure

The present report is intended to function as a tool for the Mikisew Cree to take further actions in the design, operation, and reclamation stages of Shell's JEMA and the PRMA Projects. Our review consolidates the reports provided by each of the contributors into a single, integrated, comprehensive report. The review is structured by discipline, each of which addresses the following questions:

1) Is the baseline information adequate to be used as: a) foundation for impact predictions; and b) a benchmark for monitoring programs?

2) Are the methods for data collection applied in a manner that will enable rigorous quantitative analyses?

3) Are plans to monitor and manage residual impacts explicitly and concretely described for the lifespan of the Project?

4) Does the information address issues raised by the Mikisew Cree?

The questions address the technical quality, basis of conclusions reached, and predictions. The technical quality is then related to its usefulness for follow-up programs, thereby addressing the confidence that the Mikisew Cree may have in the environmental management programs during the lifetime of the project. The general comments highlight overarching and often cross-discipline issues, which are sometimes followed by more specific comments that can be discussed by a general audience. The specific comments often may require the attention of specialists. In past review processes, the specific comments typically have been discussed by experts retained by the Proponent, the regulators, or the Mikisew Cree. The text **in bold,** which is also compiled under the Recommendations section, features the requests or questions directed to the Proponent (Shell). The Recommendations section lists action items that the Mikisew Cree may consider in future dealings with the Proponent and the regulators. Each of these recommendations may lead into a series of discussions, workshops, or action plans that may assist the Mikisew Cree and Shell in advancing towards their vision of resource use.

The executive summary provides an overview of the most salient points in this review.

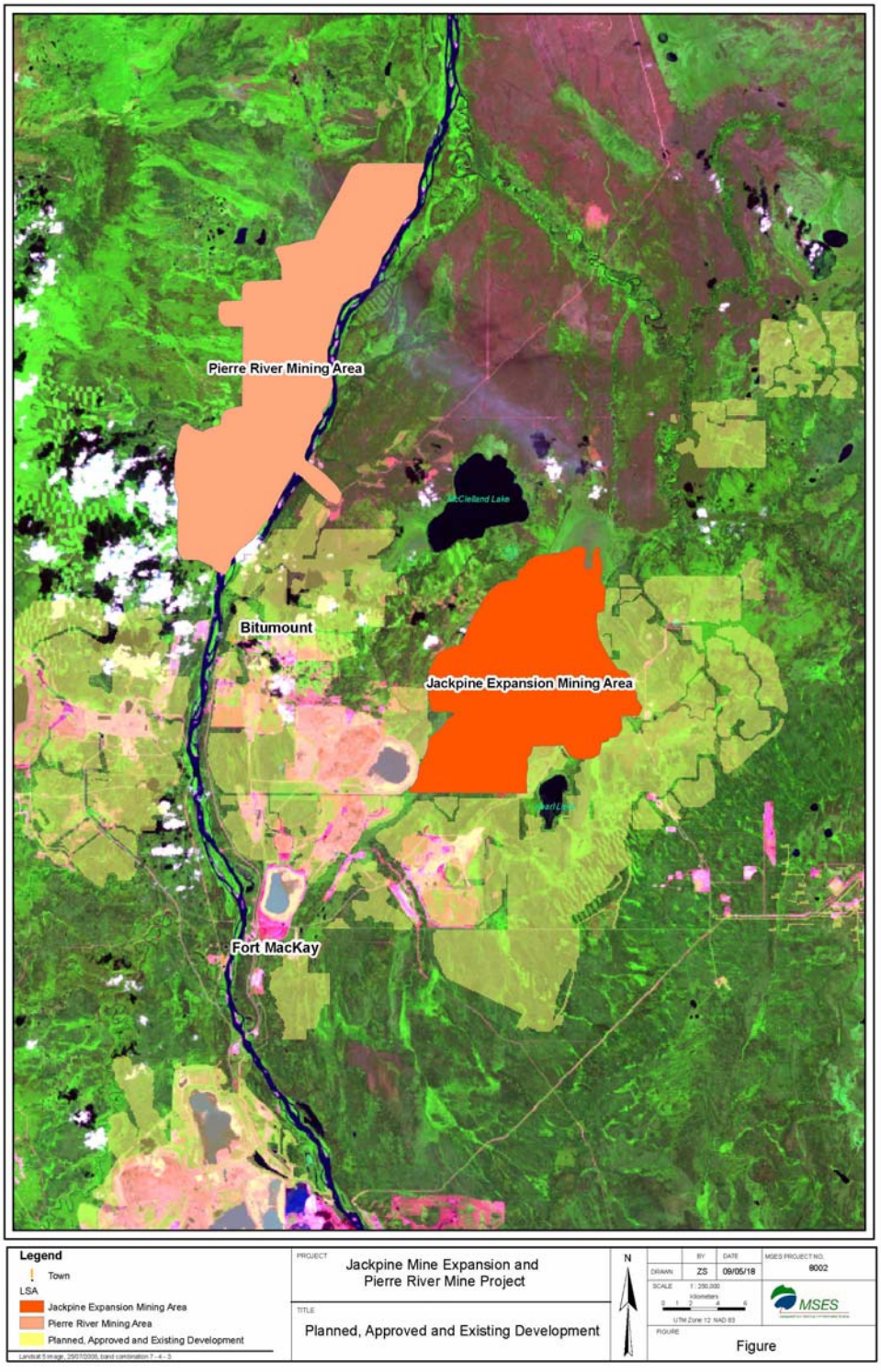


Figure 1-1: Location of the Jackpine Mine Expansion and Pierre River Mine Projects

2.0 General Observations

2.1 Targets & Benchmarks

2.1.1 Is there evidence for the application of local/regional targets used for environmental management?

Impact predictions, no matter how solid or robust, need to be tested during monitoring and follow-up programs (Morrison-Saunders and Arts 2004). For the ongoing comparison with baseline data and for the detection of effects that were not predicted, the most fundamental necessity is that both the baseline and the monitoring information must be quantifiable. For a useful monitoring program, testable questions must be developed (Burns and Wiersma 2004). Shell's EIA is weak in providing a foundation for the testing of predictions and for the measurement of mitigation effectiveness. For example, there is no "yardstick" for sub-lethal effects on fish health (e.g., reproductive or year-class failure) or for how much air emissions will be allowed to exceed Alberta Ambient Air Quality Objectives (AAAQO) (readings already noted above AAAQO in the region). Moreover, specific targets (e.g., vegetation species composition and percent cover) to define reclamation success are not provided.

Shell relies on regulatory conditions to set the targets for emission, protecting fish health or setting the targeted land use after closure. However, it is evident in our review across the disciplines that many targets are not set, and even where they are set by regulators, they appear to be allowed to be exceeded on a regional basis. Finally, regulators seem to expect that the closure land uses will not necessarily be identical with pre-disturbance land uses, but there is no clear vision as to what the closure land uses should be. The Mikisew Cree certainly did not have any input in forming that vision.

2.1.2 Is there evidence for the application of benchmarks or standards (aside of targets) that would guide environmental management?

Most disciplines noted that Shell adopted the benchmarks and standards that are given by the regulators or in guidelines set out by regional associations (e.g., RAMP or CEMA). However, it is unclear how the exceedances of these guidelines and standards will be enforced. In Shell's own monitoring programs from existing operations several exceedances on, for example, water quality have been noted, but no information is available on how management and mitigation will be altered to reduce such exceedances. Similarly, numerous guidelines on reclamation exist, and Shell commits to following such guidelines, but it is unclear how the adherence to these guidelines will be first monitored, and then enforced.

2.1.3 Base line data: are baselines set for the 2007/08 scenario (as opposed to pre Oil Sands development)?

Shell regarded the baseline to be represented by the conditions occurring during the preparation of the EIA. However, under current conditions a large number of environmental parameters have been already altered by industry. The result of the alteration from pre-industrial conditions to current conditions is a change in the opportunities of how the landscape can be used. Treaty Rights in particular have already been affected by these alterations. The exact effects of such alterations remain unstudied and unknown. The Mikisew Cree regard 1965, when the impacts of intensive oil sands development began to be felt, as the date needed to establish the baseline data.

By adopting current conditions as the baseline, this question still remains to be addressed: What if the current disturbances already approach or surpass a threshold at which the culture of First Nations (FNs) ceases to be viable? It is therefore necessary to determine change over time when modeling cumulative effects. Shell should quantify landscape level disturbances and their effects on Traditional Land Use (TLU) at several points of time, including the pre oil sands development period.

2.2 Traditional Resources

2.2.1 Is there any process that identifies key traditional resources for the First Nations?

There is no discussion of involving the Mikisew Cree in any design of the impact assessment or of project design, operations and monitoring. Traditional plant potential was assessed in the EIA, including traditional plant richness and traditional plant species. However, errors in classification do not portray an accurate account of the distribution of traditional use plants. Aside of errors in vegetation classification that involves TR, the process of identifying TR required by the Mikisew Cree to exercise their Treaty Rights, appears to be flawed. This is because there is little evidence that Shell incorporated the comments and concerns submitted by the Mikisew Cree in other stages of the regulatory application process and because the Mikisew Cree were not involved in designing the impact assessment of their TR.

Therefore, it is likely that Shell's proposed projects will have adverse direct, indirect, and cumulative impacts on the environment and socio-economic conditions of the Mikisew Cree that are currently not assessed.

2.2.2 Is there a traditional resource use plan?

Shell does not present a traditional resource use plan. This is problematic for the protection of the continued exercise of Treaty Rights. For the re-establishment of TR, areas of traditional plant potential were only indirectly included in mitigation and reclamation planning. Although traditional use plants were discussed in the impact assessment and reclamation of native ecosites and wetland types is planned, there is no explicit list of traditional use plants that will be seeded in any of the reclaimed areas. Moreover, there appears to be no concrete plan to re-establish areas of high or moderate potential for traditional use.

Aside of vegetation re-establishment, there are also no plans for the maintenance and protection of any other TR. A community-based monitoring (CBM) program would be useful for this purpose but this is not currently available in the Application. The most that Shell committed to in regards to involving the Mikisew Cree in future resource use plans is a consultation for the end land use planning (that may occur at some future date) and a tour of the facilities. Neither commitment involves the Mikisew Cree in strategic decision making and the planning of resource use.

2.2.3 Is a Traditional Use Study (TUS) referenced?

No controls were introduced in the data collection process to determine if the data came from a balanced sample of land users or a large enough sample of land users. In addition, those who provided the data may have not provided a number of icons proportionate to their relative land use intensity. Therefore, the most that can be said of the traditional use data is that it may be a rough approximation of the land use from a sample of land users from Fort McKay FN. Numerous other deficiencies in the assessment of TLU have been identified.

In general, the review of the TLU and Socioeconomic sections exposed a lack of understanding of the land use and resource use by FNs. The calculations of land disturbed under current conditions and the further disturbance by Shell's proposed projects suggest that there is only a small proportion of the TLU disturbed. It appears that having a more in-depth understanding of TLU, the authors may come to different conclusions. As it stands, the authors assume that the land immediately adjacent to a mine pit is "undisturbed". They further assume that any patch of land surrounded by industrial development, no matter how small the patch, is "undisturbed". These do not seem to be correct assumptions because the zones of influence as well as the impediment of the traditional travel routes are ignored. It is apparent that a Traditional Use Study should be performed to inform all involved about the true effects of the mine development on Treaty Rights. Shell claims that additional interviews are being arranged with the Mikisew Cree and other FNs (Vol.5 S.8.3.1). It appears that further study is imperative.

2.3 Regional Environmental Management

2.3.1 Is there a regional land use plan?

Shell states (Vol. 4A, Section 1.3.2): "*the use of appropriate predictive tools and methods consistent with CEMA, WBEA, RAMP and CONRAD and any other relevant regional initiatives, to enable quantitative estimates of future conditions with the highest possible degree of certainty*". This indicates that Shell is prepared to participate (as it has in the past) in regional environmental management associations. However, the effectiveness of these associations has been questioned many times before, particularly as it relates to the protections of the continued exercise of Treaty Rights. In the past few years Shell has initiated a wildlife corridor monitoring program that seems to adequately quantify the effects of industrial disturbance on wildlife presence or movement in the area of its operations. However, even this program appears to exist in a regional planning vacuum as it does not deal with questions about where the wildlife come from or where they go and the corridors themselves do not seem to form part of a regional network of protected areas and connecting corridors. There is no evidence in Shell's Application of any better regional program that may be able to comprehensively integrate the regional planning for the protection of TLU.

2.3.2 Are the data that are needed for the comprehensive CEA available and transparent?

Some disciplines such as air quality and aquatic health noted that Shell adequately followed regulatory expectations for the cumulative effects assessment. However, the sources of data are not clear and may, in many instances, be inadequate, particularly for terrestrial resources. Data on future forestry operations, infrastructure and any other projects that do not trigger the *Canadian Environmental Assessment Act* appear to be missing almost entirely with the consequence that a cumulative effects assessment is incomplete. Some regional data sets appear to be out-dated and the use and assessment of linear disturbances in the cumulative effects assessment is unclear, if it occurred at all. Moreover, the trends and rates of change from the past to current conditions should be understood in order to evaluate any additional effects that may occur in the future. The cumulative impact assessment on TLU is particularly unclear given the lack of understanding of regional TLU and how much this land use has been degraded in the region to date.

3.0 Discipline Specific Reviews

3.1 Human Environment

3.1.1 TEK, Public Consultation and Community Based Monitoring

Key Findings: The consultation process does not involve a discussion of the concerns raised by the Mikisew Cree and there is no information on the content of the meetings or if any agreements were made and follow up plans discussed. There is no evidence that the issues relating to the protection of Treaty Rights have been resolved. Traditional Ecological Knowledge (TEK) was not used to conduct an assessment of impacts on the practice of Treaty Rights. There is no discussion of involving the Mikisew Cree in any design of the impact assessment or of project design, operations and monitoring.

3.1.1.1 Adequacy of Baseline for Benchmarks

To gain a better understanding of the consultation process, we recommend that Shell review Alberta's First Nations Consultation Guidelines on Land Management and Resource Development (GoA-Aboriginal Relations 2007), the Aboriginal Consultation and Accommodation – Interim Guidelines for Federal Officials to Fulfill the Legal Duty to Consult (INAC 2008), and the Alberta Oilsands Consultations – Traditional Use Studies (GoA 2000), which highlight the overall process and dynamics of consultations and stakeholder rights and responsibilities.

Specific Comments and Requests

1) **Issue:** No Linkages to TLU and TR
   Reference: Volumes 1 and 2, Section 15
   Concern: The details within Public Consultations section are not specifically linked to TLU or TR. The need to describe the value and local significance of TR is greatly needed, rather than merely mentioning the various FNs, IRCs, and the local communities.

2) **Issue:** Lack of Consultation Details
   Reference: Table 15-1, Volumes I and II
   Concern: The Proponent has shown a list of meetings and consultative discussions with the local communities; however, one cannot find any information on the main content of the meetings or if any agreements were made and any follow up plans discussed. The best approach may be to describe the nature of a specific meeting, what issues and concerns were discussed, and what outcomes were drawn from it, along with a summary for future/ follow-up actions. From the reports it is difficult to determine what resulted from the meetings and how the issues or concerns were mitigated or responded to by the Proponent. The issues may have been recorded and actions may

have been taken but such information is not clearly outlined in the Tables or documents. **Please provide exact details of various discussions and meetings held with local communities and how the resolution of the concerns and issues was incorporated into project development, impact mitigation, and proposed monitoring.**

3) **Issue:** No Details of Involvement in Monitoring Programs
Reference: Volumes 1, 2 and 5, and Environmental Setting Reports (ESR)
Concern: The consultative meetings with TR holders have to be more than just the random touch-and-go events. The Proponent has solidly committed to consulting and engaging with TR holders; however, there is no discussion of involving communities in any monitoring of project development and operations. **Please provide information on future plans to maintain the community consultation process following completion of the EIA review to ensure that the TR holders will have an appropriate forum for expressing their views on the ongoing development, operation, and reclamation of the Project. We recommend that the Mikisew Cree propose suitable community-based monitoring (CBM) of various project-related activities on the land. Communities could offer TEK to Shell as well as solidify a strong partnership in sustainably managing and assessing the TR on the land.**

4) **Issue:** Generalization of TEK
Reference: EIA: Volume 5, Section 8.3, pg. 8-19
Concern: The TEK/TLU assessment is not completely based on actual field data but on the review of secondary resources. There is neither any detail of the interviews nor the content of discussions and deliberations with FNs available in the TEK/TLU sections.

5) **Issue:** Lack Comprehensive Analysis
Reference: Volumes 1, 2 and 5, and ESR
Concern: The Proponent has partially presented results relating to regulatory requirements and best practices. However, most of the details are superficial and seems to be replicated from a log book. The analysis is not comprehensive and discussion covering all aspects of the local aboriginal TLU needs and realities are not provided.

3.1.1.1 Quantitative Data Collection and Analysis

Specific Comments and Requests

1) **Issue:** Lack of Details
Reference: Volumes 1 and 2, Section 15
Concern: Data collection and presentation about public consultations is not adequate. Random details of the meetings and discussions are provided in a table format. No information was provided as to how the meeting was organized (work plan or schedule), what resulted from those meetings,

and how disagreements were resolved. If the proponent uses a methodical pattern and seeks information from the stakeholders, especially FNs, in an organized and consistent way, then issues may be properly discussed, prioritized, and resolved. **We recommend that the Mikisew Cree request a thorough analysis of the meetings, next steps, and discussions.**

2) **Issue:** Unclear Whether FN Input Included
Reference: Volume 5 and ESR
Concern: It is important to know whether aboriginal populations were given the opportunity to participate in the planning or design stages and in establishing the biodiversity indicators and assessments for this application. **Please provide these details**.

3) **Issue:** Incomplete Assessment of TR
Reference: Section 8.3
Concern: Shell states that "*much of the information detailed in this assessment is sufficiently general to have application to other aboriginal people. The information presented in this application is believed to convey general views of regional aboriginal people toward the existing and proposed developments in the oilsands region*" (pg. 8, Section 8.3, Volume 5). Therefore the assessment of TR is not specifically done for the area and it is based on a combination of information resources, regional project updates, secondary resources etc. **How does this accurately convey TR in the local communities and the extent of their TR if Shell has not assessed this locally?**

4) **Issue:** Generalization of TLU
Reference: Section 3.3.1 and Fort McKay 1996a
Concern: Shell has discussed some aspects of the effects of the Project on TLU and provided a summary discussion, but only in the context of the Fort McKay FN. It appears that Shell believes these results are applicable to the whole region, which may not be the case. **We recommend that the Shell funds a TLU study to be carried out by the MCFN.**

5) **Issue:** Incomplete Integration of Information
Reference: ESR – Traditional Land Use Component, Section 3.0, pgs. 3-6 to 3-7
Concern: Shell is currently consulting with FNs on their TLU within the Regional Study Areas (RSAs) and regional information provided in these interviews will be incorporated into project planning as appropriate. It is fine that information will be integrated when it becomes available; however, **how can Shell assess the impacts of the Project on TR accurately if there are gaps in the information?** It appears that the assessments are mostly based on secondary information resources and previous assessments related to Albian Sands Energy, Jackpine Mine Phase I, Muskeg River, and others.

6) **Issue:** Literature Not Comprehensive
Reference: Throughout
Concern: The list of literature review is not comprehensive. More published resources (individual, institutional, academic, scientific, governmental) dealing with industrial developments and its implications in the oilsands region should be fully explored.

3.1.1.2 Quantitative Monitoring and Using Targets

Specific Comments and Requests

1) **Issue:** Lack of Monitoring Details
Reference: Volume 5 and ESR
Concern: Very little information for monitoring potential Project impacts on TR is provided in this section. The Proponent has committed to continuing the dialogue with the aboriginal populations to learn their viewpoints at suitable times. However, at the EIA stage, the Proponent and stakeholders should have discussed issues so that they can be duly incorporated within the EIA. **Why were these discussions not completed prior to Shell applying to the regulatory authorities?**

2) **Issue:** Lack of Assurances for Successful Reclamation
Reference: Volume 5 and ESR
Concern: Shell purports that the first 25-50 years of the project will have an impact on the resident aboriginal populations but that through successful reclamation, the land will return. **Can Shell provide examples of successful reclamation in terms of traditional resource use?** This question is highlighted within the Vegetation and Reclamation (Sections 3.2.2 and 3.5.2 in this review). **If not, how can the Mikisew Cree be assured that reclamation will be successful, especially when there are gaps in understanding the TLU in the local area?** We must be cognizant of the fact that many culturally important activities of the FNs are passed onto their future generations, but if the TR are not available to share this information, it could be lost to future generations. Shell states that they will compensate the FNs but details of what would be offered, how long, in what form, and to what extent need to be addressed. **We recommend that the Mikisew Cree request a detailed assessment about future developments on the land so that they can make appropriate decisions for future partnerships with industry.**

3.1.1.3 Addressing Stakeholder Concerns

Specific Comments and Requests

1) **Issue:** Lack Details
   Reference: EIA, Volume 1, Section 15.0
   Concern: General statements are given about a few points in the activity table within Section 15.0. **However, more details are needed so that a gap analysis may be performed and future courses of action can be clearly demonstrated.**

2) **Issue:** Lack Discussion of Project Impacts on TR
   Reference: Volume 5 and ESR
   Concern: Some details of the TR assessment is provided; however, Shell does not address how FN dependence on TLU would be affected by the Project. Only qualitative assessments through various key questions are provided and in the end, commitments for compensation measures are offered. **Please provide some details as to what these compensation measures might entail?** To pass on TEK to future generations, FNs require the TR and land to showcase their cultural traditions. **How will Shell ensure FN needs to maintain their Treaty Rights?**

3.1.2 Traditional Land Use and Socio-economics

Key Findings: The methods used to measure the socio-economic impact of the Projects on the Mikisew Cree are unscientific and based upon misunderstandings. The EIA did not assess the likely adverse impacts on the socio-economic conditions of the Mikisew Cree. The lack of planning for and accommodation of the socioeconomic requirements of FNs threatens their Treaty Rights.

3.1.2.1 General Comments

The Mikisew Cree provided Shell and AENV myriad comments and questions in an earlier review of the Terms of Reference (ToR) for the Project. However, the vast majority of these recommendations and comments were not given meaningful consideration by AENV or Shell. This is not unique, and the dismissal of FN requests (see also Section 3.5.1 in this report) does not simply make the concerns, that the EIA is not comprehensive and not credible, go away.

The Mikisew Cree live and practice their culture and land use on or within proximity to the Shell leases. Therefore it is likely that these projects will have significant impacts on the environment and socio-economic conditions of the Mikisew Cree. However, no direct assessment of these effects on the Mikisew Cree is included in the Applications. Until such an assessment is carried out, it will be impossible to evaluate project impacts to the Mikisew Cree in terms of the deprivation of Treaty Rights.

As indicated by FNs reviewing the EIA process throughout the oil sands region, in addition to properly identify 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 a comprehensive Aboriginal Impact Assessment. **We recommend that Shell work with the Mikisew Cree to develop a comprehensive Aboriginal Impact Assessment.**

Further details of the review on socioeconomic aspects of the Application are presented in Appendix A of this report.

3.1.2.2 Specific Comments:

If Shell's projects are approved without addressing the likely Project impacts on the Mikisew Cree and other FNs, in light of their Treaty Rights and addressing what is needed for the meaningful exercise of those rights, the FN's ability to provide input into mitigation, compensation and project design will be hindered. **How can these Project impacts on the Mikisew Cree's Treaty Rights be minimized if a proper assessment has not been conducted?** According to the consultation principles the projects should minimize the socio-economic effects and must plan to do so before the projects are approved.

It has been the policy of Governments to establish a separate consultation process to deal specifically with consultation on Treaty Rights. However, there does not appear to be a separate consultation process for these applications. Moreover, if Alberta intends to engage in such consultations, there is currently no mechanism or process in place to integrate the results of any such consultation into the regulatory process. Therefore, if the regulatory process is somehow not consistent with the legally required consultation process, it is important that these issues and omissions be identified at this time in the process so that the required proper consultation will take place. Given the current state of this Application a separate consultation process should be established, including setting out how any results from that process would be integrated into the regulatory review and decision-making process.

There is concern about the mitigation proposals put forward by individual companies. Having regulators and decision-makers consider them adequate while companies continue to apply for more projects without conducting a full regional impact assessment or socio-economic study of impacts denies the rights of the Mikisew Cree. A strong focus is required on potential impacts on constitutionally-protected rights through a proper consultation process as well as adherence to the legal responsibilities of the Crown (as dictated by the Supreme Court of Canada) to support the preservation of the Aboriginal culture, and allow the FNs to exercise their rights.

The Application states that the Mikisew RSA is based upon the Traditional Territories of the Mikisew Cree First Nation. The total area that the Mikisew Cree People have historically used extends well into the Northwest Territories, covers parts of Saskatchewan and a large portion of northeastern Alberta. The use of the number of hectares in the historical traditional territories of the Mikisew Cree as a denominator in a calculation to measure current impacts to the Mikisew Cree First Nation land use is incorrect and, at best, unscientific. It is not based on an informed approach to the study of land use by aboriginal people and is clearly an unacceptable method for assessing impacts. As it stands, the authors assume that the land immediately adjacent to a mine pit is "undisturbed". They further assume that any patch of land surrounded by industrial development, no matter how small the patch, is "undisturbed". This calls into question the reliability of the impact predictions presented in the Application. This kind of analysis assumes that Mikisew members can easily exercise their rights anywhere within their Traditional Territory. It ignores the realities of actual land use patterns, the ability of Mikisew Cree to exercise their rights based on where they live, and other relevant data. Furthermore, this sort of approach makes exactly the kind of error that the Supreme Court of Canada cautioned against in the Mikisew Case (Mikisew Cree First Nation v. Canada (Minister of Canadian Heritage) 2005) – telling aboriginal people that they can simply "go elsewhere" to practice their rights. **What are the implications of this project for the continued and future traditional land use of the FN? We note, in particular, that the Application does not consider the impacts of the "taking up" of lands (either through direct footprints or zones of disturbance or through fragmentation) within the Traditional Territory of the Mikisew Cree and how this will impact the Mikisew's ability to exercise their Treaty Rights.**

The information and data collected for the purposes of this application is far from adequate in supporting an appropriate consultation process for the socio-economic impacts of this project on the Mikisew Cree First Nation. Even if there were a separate Crown consultation process, which there does not appear to be, the information should be collected by the proponent, other proponents, and the federal and provincial governments through a larger baseline study to show the potential effects on the First Nation. This has not been done in this application. A list of the types of information that should be collected in order to accomplish proper consultation can be found in Appendix A of this review including additional comments on information gaps in TLU and Socio-economics.

3.2 Terrestrial Resources

3.2.1 Wildlife

Key Findings: The sampling and analytical procedures do not allow for a quantification and objective understanding of current conditions that are required to define the success of re-establishing wildlife resources. Site-specific mitigation plans are required, but are not apparent. There is no explicit link between the assessment of effects on wildlife and the resulting effects on Traditional Resource Use. Shell has not demonstrated, that regional planning for wildlife is being done and that it works.

3.2.1.1 General Comments:

It is apparent that a tremendous amount of effort went into collecting data and generating the Wildlife ESR and various assessment sections throughout the EIA. However, although large amounts of data were collected to determine baseline (current) conditions for a wide variety of species, much of the information does not appear to have been used in the actual assessment. For example, although data was collected via waterfowl surveys, breeding bird surveys, and bat surveys, most of the species-specific information was not used in the actual assessment of impacts to wildlife. Rather, much of the information was excluded because of the focus on different Key Indicator Resources (KIR) in the assessment (some of which were overlapping in terms of representation – see below). It is not clear why those KIRs selected for the Environmental Setting Report (Wildlife ESR, Table 5.2-6) were different than those used in the actual environmental assessment (Volume 5, Table 1.3-2). No rationale is provided regarding the decision to exclude certain KIRs.

Wildlife data was collected in and around the two local study areas (LSAs) between 2005 and 2007; data collected for the JEMA and PRMA LSAs are reported separately. Other data collected for Shell EIAs and monitoring programs was also used but grouped separately from that collected in 2005 and 2007 in certain instances (Wildlife ESR, Section 5.2, Table 5.2-2). Regardless, it appears that the delineation of respective LSAs was an afterthought to data acquisition. Sampling occurred outside of LSAs where, arguably, the greatest impacts to wildlife will be realized (Wildlife ESR, Figures 5.2-2, 5.2-4, 5.2-6, 5.2-7, 5.2-8, 5.2-10 and 5.2-16). Stratification of sampling within and among years is generally not apparent (Wildlife ESR, Figures 5.2-1, 5.2-3 and 5.2-6). Sampling methods are varied within and between years (Wildlife ESR, Figures 5.2-3 and Figures 5.2-4), follow existing disturbances (Wildlife ESR, Figure 5.2-5 and 5.2-9), or omit large sections of an LSA within a certain year (Figure 5.2-7 and 5.2-8, 5.2-9, 5.2-10 and 5.2-15). Regrettably, most regulators do not appear to agree with the need for improved data quality rather than improving data quantity and requiring rigorous statistical analyses of EIA predictions.

For example, how will the results of photographic bait stations and trail cameras in the Wildlife ESR be used in the evaluation of predicted project impacts to wildlife?

Shell has not demonstrated, individually, or as part of the development proponent assemblage in the Alberta Oil Sands Region, that regional planning for wildlife is being done and if it is being done, that it works. As a result, the Mikisew Cree have little confidence that Shell or the oil sands development proponent troupe as a whole is prepared, capable, and willing to resolve increasingly complex wildlife-related issues. In turn, this leads to the questioning of the overall capability and preparedness of Shell to honestly and progressively address and mitigate expected and unexpected project effects upon wildlife. Unfortunately, this is not unique to Shell; other development proponents are similarly tasked with implementing individualized management systems for wildlife across lease holdings. This is because those responsible for designing and implementing appropriate regulations for regional wildlife populations have actually failed to regulate impacts to wildlife by not providing specific guidelines or legislation for wildlife disturbance and wildlife habitat loss.

Although there are expected losses at the LSA level for wildlife that will last for a period of 25 to 50 years (depending upon the species) and are considered of "high" environmental consequence, Shell expects that after closure and successful reclamation the environmental consequence rating will be reduced to negligible or low. However, it is not clear exactly where wildlife will go during these 25-50 years or where animals will originate from to recolonize the disturbed landscape after closure and successful reclamation. In addition, exactly when will closure be deemed "over" and reclamation is declared "successful" remains an enigma.

Information on potential project impacts for JEMA and PRMA are often presented in a confounding manner. For example, the Project is predicted to have a high environmental consequence in the Application Case at the LSA scale before closure. However, a negligible to low environmental consequence is predicted for wildlife at the scale of the LSA and RSA after closure and reclamation. Shell then follows this summary with information on wildlife movement in the PMRA: the Project is predicted to have low environmental consequence on wildlife movement within the PMRA LSA after mitigation. A negligible to low environmental consequence is predicted after closure at the scale of the LSA and RSA after closure and reclamation. Merits of supposed successful reclamation aside, it is not clear if Shell is comparing the Application Case in both instances. This is but one example of hard-to-follow comparisons found throughout the EIA with respect to wildlife.

The potential for ecosystem shifts (i.e., changes in terrestrial/wetland habitat types from pre-disturbance to reclamation) was not directly considered within the EIA, although it was acknowledged that there will be a shift from both terrestrial (upland) and wetland habitats to primarily terrestrial habitats. Within an 80-year assessment timeframe, a shift from young to middle-aged habitats (note that they refer to these

as early and mid successional; however we disagree with this terminology-see Vegetation Section 3.2.2 in this report) (Volume 5, Section 7.1.2, pg. 7-6). Relative prediction confidence and reclamation success were apparently not specifically addressed. The total level of disturbance in the Project LSAs (64%) may cause ecosystem shifts in the undisturbed remainder (Volume 5, Section 7.1.2, pg. 7-3), particularly if there is a high amount of edge, smaller patches of forests, and significant changes in groundwater flow that affect hillslope moisture and nutrient regimes. Ecosystem shifts are likely to occur in areas where disturbance approaches 50% of the landscape (Andren 1994, Hargis *et al.* 1998, Komers 2002). The most likely changes would be an increase in non-native and invasive plant species within small reclaimed areas with a high amount of edge and the potential loss of species (through mortality) that could not tolerate drier conditions caused by reductions in groundwater amounts and flow. **Will recovery through progressive reclamation happen rapidly enough to avoid ecosystem shifts?** Addressing ecosystem shifts may require much more effort and yet to be developed processes than Shell has currently proposed. Local and regional shifts to altered ecosystems in ten to twenty years may greatly alter the conditions for reclamation; affect the survival of some plant species and natural recruitment of some wildlife species. **The Mikisew Cree should request that ecosystem shifts be included as indicators for monitoring and triggers for adaptive management.** Signs of ecosystem shifts are yet to be defined, but may include major changes in moisture and nutrient regimes over large areas (e.g., for example, going from a mesic, medium nutrient condition to a subxeric, poor nutrient condition on a particular hillslope position).

3.2.1.2 Adequacy of Baseline for Benchmarks

The baseline information is partly adequate to be used as a foundation for impact prediction and monitoring programs (depending upon explicit goals and objectives). As expressed by the Mikisew Cree previously, questions remain surrounding the use of pre-disturbance conditions as a benchmark or target in reclamation activities (not floating baseline or current conditions), including associated wildlife recolonization of disturbed areas. **Clarification is required for (i) what the baseline data represent and (ii) what the baseline data will be used for in the future.**

It is apparent that a large amount of effort went into the design and generation of various wildlife habitat models and resource selection functions, as presented in the regulatory submission; these are presumably to aid in the mitigation of potential project impacts to wildlife. However, it seems that the models developed and presented by Shell contain a multitude of underlying assumptions that vary among wildlife KIRs and between the LSAs and RSA. In addition, the various analyses were only carried out on a few select wildlife KIRS (see below for more specific comments and questions).

Specific Concerns and Requests

1) **Issue:** Temporal Boundaries
Reference: Volume 5, Section 1.3.4.1, Table 1.3-1
Concern: Tentative "start of closure" dates are provide for the JEMA and PRMA; these are 2065 and 2049, respectively. **However, no "end of closure" dates are provided. This information would shed light on the potential for Traditional Land Use by the Mikisew Cree, such as wildlife harvesting, if wildlife recolonization of disturbed areas is successful. Can such information be provided?** In addition, although there will be some phasing of the removal and reclamation of terrestrial systems, the EIA uses a conservative approach where either everything is undeveloped, developed, or reclaimed so as to not underestimate potential project effects. However, this unrealistic all-or-nothing approach does not inform the Mikisew Cree of how or when Treaty Rights associated with wildlife will actually be impinged. **Can this information be provided so that it may be communicated to the Mikisew Cree community members? If not, why not?** Shell is also considering an accelerated or alternative project scenario, which would advance the proposed timing of JEMA and PRMA; however, it is not clear what, exactly, this scenario entails and how it would impact EIA predictions associated with wildlife (although Shell claims that it will not). **If areas are disturbed, construction is carried out, and operations commence at a faster rate than presented, why wouldn't this affect EIA predictions for wildlife and wildlife habitat? Wouldn't disturbance be more intense in the sense that the construction and operation schedule is compacted? How would the reclamation of disturbed areas, and subsequent wildlife recolonization, be impacted?**

2) **Issue:** Key Indicator Resource Selection
Reference: Volume 5, Section 1.3.5, Table 1.3-2, pg. 1-25
Concern: Although there are myriad wildlife KIRs to select from that are of special management concern, are representative of certain habitat types, or act as keystone or umbrella species, Shell chose to use resources in assessments of two old growth forest birds (barred owl and black-throated green warbler), rather than assessing the guild of birds that would have been included under the guise of "old growth forest birds". **Upland birds and waterfowl were not included as KIRs. Please elaborate and explain.**

3) **Issue:** Key Questions for the Project
Reference: Volume 5, Section 1.3.5, Table 1.3-3
Concern: Shell has used many different Key Questions in the assessment of the Project on wildlife. **Although wildlife abundance, habitat, and movements are examined, wildlife mortality does not appear to have been addressed as a "Key Question". Please explain why wildlife mortality does not appear to have been addressed as a "Key Question".**

4) **Issue:** RSFs and Habitat Suitability Index (HSI)
Reference: Appendix 5-4
Concern: There are innumerable questions surrounding the RSF and HSI models. There does not appear to be any discussion of the ecological context of the HSI mapping and RSF results. **How will the RSF results and HSI maps be used in Project planning and wildlife conservation? Will important wildlife areas be avoided? How well do HSIs agree with survey data? In addition, what are the recognised limitations of the RSF data and the possibility of false negatives? What degree of confidence does Shell have for these results given unproven reclamation and unclear regional development scenarios? How does wildlife monitoring data collected from the Muskeg River Mine and Jackpine Mine – Phase 1 compare to RSF and HSI predictions?**

5) **Issue:** Wildlife Modelling – Alberta Vegetation Inventory (AVI) Data Accuracy
Reference: Appendix 5-4
Concern: AVI data were used to build LSA models. However, no information on the actual accuracy of the AVI data is presented in the wildlife Sections of the regulatory submission. The accuracy of the HSI models and RSFs will be influenced and compounded by the accuracy of the AVI data. **What is the range of accuracy associated with the AVI data used in the various LSA Models?**

6) **Issue:** AVI Data – RSA Models
Reference: Appendix 5-4, throughout
Concern: Shell has indicated that the AVI data were not available at the RSA scale. Does this mean that RSA-level models are inherently more inaccurate than the LSA models?

7) **Issue:** Habitat Fragmentation Analysis
Reference: Appendix 5-4, Section 2, pg. 72
Concern: Habitat fragmentation analysis was performed for moose, lynx, fisher/marten, and black bears. These KIR species were selected because they are of particular management concern and are representative examples of wide-ranging species that may be sensitive to habitat fragmentation at both the local and regional scale. **Can Shell explain why habitat fragmentation analyses were not conducted for the remaining wildlife KIRs?**

8) **Issue:** Wildlife Habitat Modelling – Results
Reference: Appendix 5-4, throughout
Concern: What do the <u>combined</u> results of HS and RSF modelling, Habitat Fragmentation Analyses and Linkage Zone Analysis mean for each wildlife KIR at the LSA and RSA levels?

3.2.1.3 Quantitative Data Collection and Analysis

Plans to monitor and adaptively manage residual impacts are not explicitly described for the lifespan of the Project or in the event that reclamation efforts fail. Site-specific mitigation plans are required, but are not apparent in the regulatory submission.

Specific Concerns and Requests

1) **Issue:** Impact Assessment Criteria and Environmental Consequences
   Reference: Volume 5, Sections 1.3.6.1 and 1.3.6.2, Tables 1.3-4 and 1.3-5
   Concern: Impact criteria are consolidated into one ranking of overall environmental consequence. However, the rationale behind some aspects of the rating system remain unclear and appear to be set so as to minimize the environmental consequence rating of potential project impacts to terrestrial resources such as wildlife. For example, when considering geographic extent a score of 0 is used if the impact is at the LSA level, and for duration of effects, they are scored as a 0 if they occur for <3 years. Reversibility, which is supposedly indicative of the potential for recovery of the ecological end point (regardless of definition), is scored at either +3 (reversible) or -3 (irreversible), with Shell indicating that the majority of impacts being reversible and receiving the +3 rating and bumping up the overall ranking. Associated levels of confidence with environmental consequences are qualitative and, as such, subjective. **In addition, it is not clear how, or if, these impact assessment criteria will be evaluated through future monitoring programs. Please explain.**

3.2.1.4 Quantitative Monitoring and Using Targets

No specific targets or associated temporal scenarios for wildlife recolonization are provided. Given current regional development scenarios, it is not clear where wildlife will migrate from to reside in any reclaimed landscape.

Although Shell provides a summary of an approach and systems for managing ecological resources related to the Project (Volume 5, Section 1.7), there are apparently no management systems in place for terrestrial resources, including wildlife (Volume 5, Table 1.7-1, pg. 1-53). It is not clear why Shell does not consider having a management system in place for wildlife at the LSA or RSA level.

Although mitigation measures for the LSA are provided for wildlife, the majority of these are very general and could be applied to any oil sands development project rather than being Project specific (Volume 5, Table 1.7-1, pg. 1-53). No site-specific mitigation measures are provided and no mitigation measures are provided by Shell for wildlife that require consideration at the RSA level. **Please provide site-specific mitigation measures?**

Specific Concerns and Requests

1) **Issue:** Wildlife Movement
Reference: Appendix 5-5, Sections 1and 2, Pages 1 and 2 and Volume 3, Figures 4.6-1 to 4.6-4
Concern: Shell claims that currently approved oil sands mining projects have resulted in strips of undisturbed wildlife habitat along the Athabasca River and major tributary drainages. Given the proximity of development and increased access through these leftover strips of land, these areas can hardly be considered undisturbed. Further, these strips of land along the edge of the Athabasca River do not alleviate the issue of seasonal movements in to and out of the Athabasca River valley by ungulates and other large, wide-ranging species such as black bears. To compare this situation to that of animals moving through mountain passes in Banff, Alberta, clouds the issue of industrial development encroaching upon the Athabasca and Muskeg Rivers and the effective removal of part of the Athabasca River Valley as wildlife habitat. **How were future increased levels of noise in these corridors considered in the relative effectiveness of these areas to act as wildlife movement corridors (see Figures 4.6-1 to 4.6-4 in Volume 3)?**

2) **Issue:** Wildlife Movement – Base Case
Reference: Appendix 5-5, Section 3
Concern: Although baseline or current conditions regarding wildlife movement along the Athabasca and Muskeg River are provided, **there is no apparent consideration of re-establishing wildlife distribution and abundance to pre-disturbance (pre-development) conditions. Why not?** Baseline conditions may be the product of current oil sands exploration and development activities and not be representative wildlife movements before oil sands development. Shell admits that it is not known how wildlife will use the corridor or remnants of land along the Muskeg River once the JEMA is developed. **Have various corridor options (widths and lengths) been considered for wildlife movement or will the corridor design simply be a function of minimizing resource sterilization? Can preliminary corridor design criteria be provided?** The Mikisew Cree are seeking development proponents to put things back the way they were before oil sands development, including wildlife. **Are the results of current monitoring programs for the Jackpine Mine – Phase 1 and Muskeg River Mine being compared to EIA baseline conditions? To pre-disturbance conditions?**

3) **Issue:** Wildlife Movement – Monitoring Corridor Effectiveness
Reference: Appendix 5-5, Section 6
Concern: Shell's proposed mitigation for the Athabasca River corridor is predicted to reduce the effects of the Project on wildlife movement in the RSA by answering questions that link habitat effectiveness and connectivity to wildlife population dynamics in the Alberta Oil sands Region. However, no details surrounding these questions have been provided in the EIA. Can these detailed

questions be provided? **Have the Mikisew Cree been meaningfully consulted regarding this proposed monitoring of corridor effectiveness?**

4) **Issue:** Wildlife Movement
Reference: Volume 5, Section 7.1.3
Concern: Although Shell claims that wildlife movement will be provided under the Athabasca River Bridge on the east and west banks, no detailed information is presented in the various wildlife sections of the regulatory submission. This bridge appears to be yet another pinch-point for wildlife movement along the Athabasca River Valley. **Please provide additional wildlife passage information in the context of the proposed Athabasca River Bridge.**

5) **Issue:** Wildlife Habitat Change
Reference: Volume 5, Section 7.1.2, Page 7-4
Concern: Shell claims that high quality habitat for 7 of 9 wildlife KIRS will increase after closure and reclamation as a result of increased terrestrial habitat in the reclaimed landscape. Although Shell chooses to view this highly-speculative rate of unnaturally high-quality habitat as a positive outcome (should reclamation be successful), no associated temporal scenario for wildlife recolonization is provided. In addition, there are no estimates provided for waterfowl recolonization, which are highly dependent on the wetlands being removed (and end pit lakes (EPL) have not been proven as a viable option).

6) **Issue:** Terrestrial RSA – Residual Effects
Reference: Volume 5, throughout and Figure 1.3-1
Concern: Shell states that in the Application Case, residual effects of the Project on wildlife in the RSA are considered to be negligible to low, as a result of successful mitigation (reclamation). However, this low to negligible environmental consequence is more likely the result of the large RSA diluting potential impacts to KIR wildlife populations.

7) **Issue:** Rare Species – Yellow Rail Example
Reference: Volume 5, Section 7.1.2, Page 7-7
Concern: Shell has indicated that the effects on yellow rail habitat will be high in magnitude, resulting in a high environmental consequence for yellow rail at the LSA level. How is this outcome considered acceptable? What feedback has Shell received from Environment Canada and ASRD regarding this potential impact? Shell claims that because yellow rail habitat likely occurs throughout the RSA, the loss of yellow rail habitat in the LSAs does not affect the viability of the regional population. This reasoning is flawed for at least two reasons: (1) the vast majority of the RSA outside of the Project will be developed by other oil sands proponents and (2) finding animals that are rare is difficult, if not unlikely. For that reason, it is understood that the effects assessment on yellow rail and other rare species is laden with a high degree of uncertainty. Environment Canada has a great deal of expertise in rare species surveys and associated protection measures. It is understood that the proponent cannot survey all areas of the Project that may harbour yellow rail (or other listed species), but given this understanding, there could be groups of yellow rail (or other listed species) that remain undetected even though field surveys were conducted. If such groupings exist and they suffer direct mortality or complete habitat loss, the effect could be devastating for the regional population. **Can Environment Canada or ASRD provide advice on how monitoring and follow-up programs can be designed to evaluate the impact predictions and protect any potential yellow rail populations (or local aggregations) from the effects of the Project? Is there a guideline for any given percentage of the potential habitat that would need to be surveyed in order to assure that the chance of affecting locally aggregated populations of SARA-listed species is minimal?**

3.2.1.5 Addressing Stakeholder Concerns

The information in the regulatory submission application does not specifically address issues raised earlier by the Mikisew Cree. There is no explicit link between the assessment of effects on wildlife and the resulting effects on Traditional Resource Use, and Treaty Rights. Targets for re-establishment are not provided specifically for TR (i.e., harvested species such as moose, black bear, waterfowl, beaver, muskrat, etc). This information could be derived by examining the baseline data in association with estimates of pre-disturbance conditions for wildlife and pre-disturbance use of wildlife. It is not clear why this was not done to alleviate some of the uncertainty the Mikisew Cree have with respect to what Shell envisions as a post-project landscape and set of ecosystems.

Earlier input by the Mikisew Cree with respect to the Terms of Reference (ToR) has apparently not been accommodated by Shell. Additionally, past reviews of EIAs (i.e., the Muskeg River Mine Expansion) brought forward issues of concern related to targets and benchmarks for monitoring wildlife

populations, wildlife habitat loss, wildlife recolonization of disturbed land, ecosystem shifts, impacts to wildlife populations, and increased access and pressure by predators and hunters. These issues raised previously by the Mikisew Cree appear to have been ignored by Shell in the current regulatory submission and need to be addressed in order to determine the degree or amount of Aboriginal and Treaty Right deprivation.

The Mikisew Cree have voiced concerns surrounding the tainting of wildlife and fish as the result of pollutants from oil sands operations. A wildlife health risk assessment was carried out as part of the regulatory submission (Volume 3, Section 5.4). The wildlife health risk assessment concluded that there is minimal contribution of the Project and future projects to wildlife health risks (low to negligible in magnitude for various wildlife receptors) (Volume 3, Table 5.4-23). However, this conclusion does not consider Traditional Resource Use and the ecological context of "low" magnitude residual effects. Although Shell provides some information that TEK acknowledges that air emissions have changed traditional resource use, no methods to minimize this are provided (Volume 3, Section 5.5.3).

Specific Concerns and Requests

1) **Issue:** Issues Scoping
   Reference: Volume 5, Section 1.3.5, Page 1-20
   Concern: Although Shell claims that the identification of issues of greatest concern to regulators and stakeholders was the first step in the evaluation process, it is not clear if Shell considered the current concerns of the Mikisew Cree regarding wildlife in a holistic manner, identifying the interrelationships of wildlife, land, water, and air. Specific Mikisew Cree concerns, and the steps taken to address these concerns, were not apparent in the Application. **What specific issues were identified by the Mikisew Cree during the development of the current regulatory submission?**

3.2.2 Vegetation

Key Findings: Some aspects of the baseline data may not be adequate to properly understand pre-disturbance conditions. This is problematic for impact predictions, particularly relating to wetlands and burns. The classification of some areas as "burn" indicates a misunderstanding of boreal forest dynamics. There is a lack of accuracy assessment of vegetation data sources used for mapping. There is a lack of specific details, including targets, in the monitoring program.

3.2.2.1 General Comments

The Terrestrial Vegetation, Wetlands, and Forest Resources Environmental Setting Report for the JEMA and PRMA EIA addresses seven KIRs: lichen jack pine communities, riparian communities, old growth forests, peatlands, patterned fens, rare and special plant communities, productive forests, rare plants, and traditionally used plants (Terrestrial Environmental Setting Report (TES) -Table 3.3-6, pg. 3-38). In addition, three indicators of the Sustainable Ecosystem Working Group of the Cumulative Environmental Management Association (CEMA) were included: area of vegetation types; pattern of vegetation types; and age of vegetation types (TES -Section 3.3.7, pg. 3-52). Analyses of these KIRs are dependent on data from four main sources: land cover mapping in the RSA; AVI mapping of the LSAs; ecosite phase and wetland type mapping in the LSAs; and plant inventory surveys from the Oil Sands Region and the LSAs.

Some overarching concerns with the vegetation sections of this EIA include: 1) some inappropriate analysis of baseline data, 2) inadequate sampling in some ecosites, 3) lack of specific details, including targets, in the monitoring program. These are briefly described below.

Some aspects of the baseline data are problematic and affect their use as a foundation for impact predictions. It is acknowledged that wildfires play an important role in the boreal forest. However, the calculation of stand attributes (including old-growth forests) that vary over time and space (using AVI data of questionable accuracy) and the classification of some areas in the RSA and JEMA LSA as "burn" indicate a misunderstanding of boreal forest dynamics that affect several aspects of the assessment of Project effects. The calculations of stand attributes do not provide any meaningful information about the pre-disturbance landscape. **Please justify use of stand attribute calculations for a description of the pre-disturbance landscape. Please change classification of areas as "burn" to their specific ecosite or wetland type. This misclassification results in an underestimation of the losses of native vegetation/wetlands and an inaccurate assessment of Project effects on traditional use plants, biodiversity, forest resources, and rare plants.** This is an important concern particularly because the area involved is not trivial (16% of JEMA and 9% of RSA).

Methods of data collection, including the number of detailed vegetation samples, were appropriate in both the JEMA and PRMA LSAs. However, the distribution of sample plots is not adequate. **Please explain why detailed vegetation plots for verifying ecosite/wetland types were not conducted in some ecosite/wetlands types or in cutblocks and other disturbances in either the JEMA or PRMA LSA.** For samples taken outside the LSAs, little information is provided making it difficult to assess the appropriateness of using these data in this EIA.

Few specific details of the monitoring program are provided, making it difficult to evaluate the adequacy of monitoring. Given the questions about sampling design, particularly relating to wetlands and burns, baseline data may not be adequate to properly understand pre-disturbance conditions. Pre-disturbance conditions need to be quantified accurately in order to evaluate the success of reclamation (see Section 3.5.2 Reclamation in this review).

3.2.2.2 Adequacy of Baseline for Benchmarks

The regional map was not based on AGCC but rather a satellite image classification was done by Golder. The methods for this classification are somewhat obscure and an accuracy assessment is lacking. Without clarification of methods and an accuracy assessment, the land cover map is not adequate as a foundation for impact predictions and benchmarks for monitoring the area and pattern of land cover classes.

Impact predictions on rare plants are fairly well based given the quality of the plant inventory surveys in the LSAs. Means and standard errors, trends, and confidence intervals were not discussed in the baseline vegetation section, except for average percent cover of ecosite phases and wetland types in the LSAs (TES-Table L-1, pg. L-18; Table N-1, pg. N-22) and descriptive statistics for species richness (TES - Table 3.5-10, pg. 3-105; Table 3.6-9, pg. 3-166; Figures 3.5-7, -8, and -9, pg. 106-108; Figures 3.6-7, -8, -9, pg. 168-170). Sample sizes for vegetation surveys in the LSAs (aerial, detailed plots, and rare plant) were provided (TES -Table 3.5-1, pg. 3-78; Table 3.6-1, pg. 3-139). For monitoring change over time and detecting trends, the natural variability among measured parameters should be included in the benchmark equations. In addition, control sites need to be established within areas that will not be disturbed by future cumulative effects to be able to detect future changes in the project area.

Please include the detailed information on basic statistics in order to facilitate the monitoring of change over time. This information is also necessary to assess the accuracy for the land cover classification in the RSA.

The Proponent presents results related to TR by using traditionally used plants as a KIR for the vegetation component of the JEMA and PRMA EIA. The selection of traditional use plants (TES - Appendix K: Table K-1, pg. K-1) appears to have been based on the consultation with elders from Fort McKay. The vegetation types in the LSAs and land cover classes in the RSA were ranked for traditional plant potential based on the summed score of traditional plant abundances. Lichen jack pine communities were selected as a KIR, partly because of their importance for traditional use. However, ecosite phase a1 (lichen jack pine) ranked low for traditional plant potential but the value of the lichen jack pine communities should be ranked as higher because it provides important critical habitat for woodland caribou populations, a traditional resource. **Coniferous jack pine in the RSA and ecosite**

phases a1 (lichen jack pine, Central Mixedwood; bearberry jack pine, Athabasca Plain) in the LSAs should be ranked high for traditional plant potential.

The environmental setting (baseline) report includes disturbance footprints of all current and approved projects, even those that were the result of Shell's explorations in the LSAs. **To determine change over time when modeling cumulative effects, please consider quantifying landscapes at several points of time, including the pre-oil sands development period**. At the landscape level, satellite data from past dates is available and predevelopment scenarios can be obtained by back casting. In addition, data from multiple past dates is necessary for calculating the natural variability of chosen parameters within control vegetation communities, useful for assessing trends toward or away from monitoring benchmarks.

Specific Concerns and Requests

1) **Issue:** AVI Data and Data Analysis
   Reference: Terrestrial Environmental Setting Report (TES), Sections 3.5 and 3.6
   Concern: AVI data are used to describe forest stand attributes and determine areas of old-growth forest in the JEMA and PRMA LSAs. Unfortunately, this data has been found to be inaccurate, particularly in the use of tree height to obtain tree and stand age. Without using accurate methods in the field to verify the tree/stand ages obtained from AVI data (Gutsell and Johnson 2002), one is left to question the validity of the analyses based on these data, i.e., area of different stand ages, including old-growth forest.

   Tables 3.5.2 (JEMA) and 3.6.2 (PRMA) show the percent distribution by overstorey density class, overstorey composition, and structure for each ecosite/wetland type. Tables 3.5-3 (JEMA) and 3.6-3 (PRMA) show the mean stand age and height and percent distribution by age and height class for each ecosite/wetland type. These data are simply a snapshot in time of stand attributes that vary over time. All of these attributes vary widely across each ecosite/wetland type because of the way wildfire affects the forest. To summarize briefly, the boreal forest is a mosaic of stands with different times since the last fire. The mosaic is a result of more recent fires burning over areas that have burned at different times in the past (Johnson and Gutsell 1994; Weir *et al.* 1999). The fires that burn most of the area in the boreal forest are of high intensity and burn large areas; they do not distinguish between forest species or age, or between areas that are drier or wetter (e.g., riparian zones next to streams, wetlands) (Weir *et al.* 1999). This means that across any one ecosite/wetland type, at any given time one should expect a wide variety of stand ages. Given that stand density and tree height changes over time, one should expect to see a correspondingly wide variety of stand density and tree heights at any given time in any ecosite/wetland type across the landscape. The overstorey composition and structure change over time, primarily because tree species have

different growth rates (Gutsell and Johnson 2002). For example, in jack pine and black spruce stands, both tree species recruit within the first few years after fire (i.e., are the same age). However, because jack pine have higher initial growth rates, they are taller for the first several decades after fire. As the growth rate of spruce becomes relatively higher, their height approaches that of jack pine (and may exceed it), such that they become co-dominant in the main canopy. Consequently, for the first several decades after fire, these mixed stands will be dominated in the main canopy by jack pine, but as time-since-fire increases, black spruce co-dominates in the canopy. This occurs in all ecosite/wetland types containing more than one tree species, including several of those found in the JEMA and PRMA LSAs. **Please discuss how the calculations presented in the Tables noted above provide meaningful information about the existing boreal forest in the JEMA and PRMA LSAs.** The Proponent already acknowledges that there are no meaningful trends in the stand density data by the statement "*there are no obvious trends in main canopy tree density among vegetation types except to show that canopy density is variable, and this variation may be related to factors including, but not limited to, stand age and stand density*." (Section 3.5.1.3, pg. 3-79 for JEMA and Section 3.6.1.3, pg. 3-143 for PRMA). **If this is the case, why present this type of information? Will the Proponent consider removing the data presented in Tables 3.5.2, 3.6.2, 3.5-3, and 3.6-3 and related discussion in the EIA?**

2) **Issue:** Baseline Data for Non-native and Native Invasive Species
Reference: TES – Sections 3.5.1 and 3.6.1
Concern: The number of non-native and native invasive species reported to have been found in the JEMA and PRMA LSAs seem small relative to the amount of area of existing disturbance, particularly linear disturbances where most of these species are typically found. In the JEMA LSA, only 7 plants were recorded in the 2013 ha of human disturbance areas and in the PRMA LSA, 29 plants were found in the 974 ha of human disturbance areas. **Were searches of non-native and native invasive species in the LSA and RSA exhaustive? If not, what are the limitations of these data?**

3) **Issue:** Baseline Data and Classification of "Burn" Areas
Reference: TES – Sections 2 and 3
Concern: There is acknowledgement that fire is a natural disturbance process that leads to forest regeneration; however, this knowledge is not reflected in the classification of some areas as "burn" in the RSA and JEMA LSA. The areas classified as "burn" are defined as forests that have burned within the last 20 yrs; 9% of the RSA (207,257 ha) and 16% of the JEMA LSA (3026 ha) is categorized as burn. Although not stated explicitly, burn areas appear to be considered less important ecologically and in some analyses are treated in a way similar to anthropogenic disturbances (e.g., burned areas classified as "disturbance" for Landscape Level Heterogeneity in TES, Section 3, Table 3.5-15, pg. 3-115; burned area classified as non-forested in TES, Section 3, Figure 3.5-12, pg. 3-119). Given the fact that all (with few exceptions) naturally occurring boreal forest stands originate after

fire, it is incorrect to classify some stands according to ecosite/wetland type and others as burned based on a seemingly arbitrary stand age. The regeneration of trees and other plants begins within the year of the fire (for spring/early summer fires) or the year following the fire (for late summer/fall fires) and continues rapidly for the next few post-fire years (Charron and Greene 2002; Gutsell and Johnson 2002). Given that the areas categorized as burn were burned by fire within the past 20 yrs, these areas should contain a wide variety of plants, including trees up to 20 years old. The actual ecosite/wetland types in these burn areas and their boundaries could be determined by conducting detailed field samples. As most stands become dominated by the same tree species found in pre-fire stands, the ecosite phases/wetland types and their boundaries should be clear from pre-burn AVI data. Therefore, the sample plots and pre-fire AVI data together could be used to classify these burn areas as to their ecosite/wetland type. Incorrectly categorizing these areas as "burn" results in an underestimate of the losses of native ecosites and wetlands in JEMA and the RSA by the Project, including areas of high, moderate, and low traditional use and rare plant potential, biodiversity, forest resources, etc. In addition, the assessment of Project effects on forested ecosite/wetland classes included burns in the non-forested category. This is inaccurate because some of these sites will have trees up to 20 years old and therefore they should be classified as forests. To accurately assess the effects of the Project on vegetation these burn areas must be re-classified as to their ecosite or wetland type.

It appears that the areas classified as burn have been sampled, with 27 detailed vegetation plots, four aerial surveys, and two rare plant surveys in burned uplands and wetlands in the JEMA LSA (TES report, Section 3.5.1.1, Table 3.5-1, pg. 3-78). Details of the dominant tree species in 438 burned stands is also provided (TES, Section 4.3.4, Table 4.3-8, pg. 4-23). **Please explain why these data were not used in the baseline data for the assessment of Project effects on native ecosite/wetlands, traditional use plants, rare plants, biodiversity, and forest resources.**

Will areas classified as "burn" in the baseline data be reclassified according to their actual ecosite or wetland types to reflect the fact that burned areas are simply young forests? Will project effects on losses of native ecosite/wetland types, areas of traditional plant potential, rare plants, biodiversity, forest resources, etc., be re-assessed based on these reclassifications?

4) **Issue:** Traditional Use Plant Potential Ratings
Reference: TES, Tables 3.5-26, 3.6-26, and 3.3-12
Concern: The measured parameters do reflect TR through assessing traditional use plant potential. Traditional use plants were selected as a species level KIR for the Projects, with the range of species based on previous studies. Each ecosite/wetland type in the RSA and LSAs for JEMA and PRMA was rated based on its potential to support traditional use plant species (high, moderate, low potential) (see TES Report, Tables 3.5-26 and 3.6-26, Figures 3.5-20 and 3.6-20). Direct losses of areas of high,

moderate, and low traditional use plant potential as a result of the Projects were assessed. In addition, Lichen - Jack pine communities were selected as a community level KIR in the LSA and direct losses of this ecosite were assessed because they provide important critical habitat for woodland caribou populations. Unfortunately these communities were ranked as low traditional use plant potential when they should be classified as high traditional use potential (see comment above).

Some of these ratings appear to be flawed because they include areas classified as burned uplands and peatlands (rated as moderate potential for traditional use plants). These burned stands should be classified as to their ecosite/wetland type and then traditional use plant potential assigned based on ecosite/wetland type. These misclassifications mean that the calculations for the area within low, moderate, and high potential for traditional use plants are inaccurate. For example, if a burned site is a young bearberry jack pine stand, it would be classified as low potential for traditional use plants (TES, Table 3.3-12). However, if a burned site is a young low bush cranberry aspen stand, it would be classified as high potential for traditional use plants. **Will the burned areas be re-classified as to their ecosite/wetland type and then the areas within low, moderate, and high potential for traditional use plants in the JEMA LSA and RSA recalculated?**

3.2.2.3 Quantitative Data Collection and Analysis

The regional land cover classification forms the basis of many RSA level terrestrial assessments that are discussed in the vegetation, biodiversity, and wildlife sections of the EIA. It is used to define, quantify, analyze, and map the RSA. Wildlife habitat suitability and resource selection models have vegetation parameters as inputs, presumably derived from the regional land cover classification (Appendix 5-4, Wildlife Modelling). **Although an important component of these assessments, the methods of data collection and analysis contributing to the updated land cover classification are not given in enough detail to evaluate their rigour. Please provide this information.**

Ecosite phase and wetland type mapping is the basis of many LSA level terrestrial assessments that are discussed in vegetation, biodiversity, and wildlife sections of the EIA. Although the LSA mapping has been completed by Shell, sampling within map units for plant species diversity, traditional use plants, and rare plants is problematic in terms of rigorous analysis because of uneven sample sizes and lack of thorough details in the EIA.

Why was no accuracy assessments of AVI conducted using vegetation plot data? In addition, please explain the amount of adjustment necessary following the conversion of AVI to ecosite phases.

Specific Concerns and Requests

1) **Issue:** Regional Land Classification
Reference: TES-Section 3.3.2.1 and 3.3.2.2
Concern: The regional land classification methods are poorly described, and lacking important details. According to the Environmental Setting Report, new imagery (August 2005) was used to update an existing landcover classification; one that had been used in other EIAs from 2002 to 2005 in the Oil Sands Region (Section 3.3.2.1, pg. 3-17). Vague in methodology, **please clarify how the new imagery was integrated with the old classification, or if an entirely new classification was conducted with the new satellite imagery, please explain how this was done.** One can only speculate that the previous classification was used for "training" sites, along with AVI data and spectral information from pixels easily identified in the new imagery (Section 3.3.2.1, pg. 3-18). The use of information from previous classifications (including AVI) to develop training sites for image classification assumes that the previous classifications are correct, increasing the likelihood of replicating error. The use of ground-truth data for training sites is preferable. **Although stated generally, how and how often were plot data used to adjust the regional map for local conditions (Section 3.3.2.2, pg. 3-26)?** Ground truth is also important for assessing the accuracy of the classification overall and the accuracy of individual classes. No accuracy assessment was described for the regional classification. In addition, the parameters set for the eCognition remote sensing software were not provided, which prevents evaluating and independently repeating the classification procedure in the future.

We recommend using ground information to develop training sites and accuracy assessments for satellite image classification. In addition, more detail (such as software parameters, algorithm, training sites, etc.) on the classification methods should be provided so that the method can be assessed and repeated in the future. Please provide an accuracy assessment of the regional land classification.

2) **Issue:** Ecosite Phase and Wetland Classification
Reference: TES- Section 3.3.1.1
Concern: Field protocols for detailed vegetation plots are described (pg. 3-11). The sampling design is not explained thoroughly, although the number of detailed inventory, aerial, and rare plant survey sites within JEMA (Table 3.5-1, pg. 3-78) and within PRMA are provided (Table 3.6-1, pg. 3-139). Table 3.5-1 shows a rough correlation between % area and number of detailed inventory plots in the JEMA, with between 0 and 5 combined detailed inventory and rare plant surveys conducted on the terrestrial ecosite phases, between 0 and 19 detailed and rare plant surveys combined on the wetland types, and between 0 to 16 detailed and rare plant surveys combined on the miscellaneous vegetation types. Similarly, for the PRMA, the number of inventory plots is roughly related to the area of the vegetation type (Table 3.6-1). Between 0 and 47 combined detailed inventory and rare

plant surveys conducted on the terrestrial ecosite phases, between 0 and 19 detailed and rare plant surveys combined on the wetland types, and between 0 and 3 detailed and rare plant surveys combined on the miscellaneous vegetation types. The detailed plot data was used to supplement published descriptions of ecosite phases and wetland types (p. 3-78) and to provide species lists of the JEMA LSA (pg. 3-79).

The species composition and average percent cover by vegetation type for the JEMA and PRMA Project field surveys are provided in Appendix L, Table L-1, pg. L-18 and Appendix N, Table N-1, pg. N-22, respectively. However, descriptive statistics on the average percent cover by vegetation type are not shown in these tables. Un-summarized percent cover data are presented in Appendix M (Table M-1, pg. M-2); the sampling scheme and statistical power can only be extracted by actually analyzing the raw data. **Besides the mean, provide descriptive statistics on the average percent cover by vegetation type.**

Ecosite phases in the LSAs were originally modeled from AVI data. Please give an assessment of how many adjustments were necessary to the modeled output. In other words, how accurate are the AVI unadjusted modeled ecosites phases?

3) **Issue:** Rare Plant Surveys
Reference: TES- Section 3.3.1 and 3.3.1.2
Concern: Rare plant survey protocols were based on the Alberta Native Plant Guidelines (ANPC 2000) and integrated with Golder Rare Plant Survey Technical Procedures (Golder 2006) with LSA surveys conducted in the springs and summers of 2006 and 2007 (Section 3.3.1, pg. 3-9). As described in Section 3.3.1.2, rare plant surveys were designed to maximize the likelihood of finding existing rare plants on ANHIC tracking and watch lists, being conducted in habitat types with the highest potential for rare plants (Section 3.3.1.2, p. 3-13). Although the number of detailed inventory, aerial, and rare plant survey sites within JEMA (Table 3.5-1, pg. 3-78) and PRMA are provided (Table 3.6-1, pg. 3-139) and mapped in Figures 3.5-2, pg. 3-80 and 3.6-2, pg. 3-142, respectively, **specifics are lacking regarding how the local study area was stratified by habitat for rare plant surveys. Please provide this information.**

4) **Issue:** Rare Plant Potential
Reference: TES- Section 3.3.6.2
Concern: Over 3000 plots from the Oil Sands Region were assessed for number of rare plant occurrences and number of sites per ecosite phase or wetland type in order to calculate a frequency of rare plant occurrence. Natural breaks in the frequency data were used to categorize the vegetation types into low, moderate, and high ranks of rare plant potential (Table 3.3-9, pg. 3-46). Regional land cover classes in the RSA were ranked for rare plant potential according to the value of their corresponding vegetation type (Table 3.3-8, pg. 3-46). **Provide details of how the LSAs**

were stratified for the rare plant surveys. Please provide the frequency data of rare plant occurrence for vegetation types and natural break values for evaluation.

5) **Issue:** Detailed Inventory Vegetation Plots
Reference: TES, Sections 3.5 and 3.6
Concern: A large number of detailed vegetation plots, aerial surveys, and rare plant surveys were conducted in both the JEMA and PRMA LSAs. However, sample plots were not conducted in a significant number of ecosite/wetlands types in the JEMA and PRMA LSAs (10/39 ecosite/wetland types in JEMA and 5/46 types in PRMA were not sampled) and no detailed samples were taken from within cutblocks and other disturbance types in the JEMA (disturbance/cutblocks = 2013 ha) or PRMA (disturbance/cutblocks = 974 ha) LSA. Most of these unsampled ecosites/wetland types only cover a small area; however all ecosites/wetland types should be sampled at least once to ensure that the ecological land classification map for assessing Project effects is accurate. Detailed vegetation plots were supplemented with samples that were taken from outside of the LSA. However, the locations and nature of these samples are not provided and therefore it is not possible to determine whether these samples are appropriate for use in this EIA. If samples were taken from far outside the LSA one would question their validity of using these in the EIA. **Will any additional detailed vegetation samples be taken to include all ecosite/wetland types and disturbances in the JEMA and PRMA LSAs? For samples taken from outside the LSA, will more information be provided, such as what site information was collected in these samples and the locations of samples in relation to the LSAs?**

6) **Issue:** Lack of Verification
Reference: TES- Sections 3.3.6.1 and 3.3.5.2
Concern: Potential riparian habitat was defined as vegetation assemblages whose structure and function are influenced by, or dependent on aquatic association, including mesic to subhydric ecosite phases, meadows, fens, marshes, swamps, and sand in the LSAs and coniferous white spruce, deciduous aspen-balsam poplar, mixedwood aspen-white spruce, non-treed wetlands and treed fens in the RSA (pg. 3-39). Riparian area data were extracted from the ecosite phase and wetland type maps of the LSAs and landcover maps of the RSA. "*The riparian category includes all potential riparian habitat within 100 m of a watercourse with a patch area greater than 0.2 ha and 0.1 ha for the RSA and LSAs, respectively*" (Section 3.3.5.2, pg. 3-35). **Please verify riparian habitat characteristics within the 100 m buffer of watercourses that defines the riparian category in the LSAs. How much does this buffer distance over or under estimate riparian habitat?**

7) **Issue:** No Verification of Attributes
Reference: TES- Section 3.3.6.2; Section 4.2.5; Section 3.4.3.1
Concern: Definitions of old growth forest generally include forest characteristics such as the presence of old trees, snags, downed logs, gaps in the canopy, and various age classes of trees. Because of difficulties in mapping these attributes, forest stands were classified as old growth based

on AVI data for canopy composition and stand age following Schneider's (2002) criteria: ≥80% coniferous (white spruce and balsam fir) at 140 years; jack pine at 120 years; mixedwood and deciduous at 100 years (Section 3.3.6.2, pg. 3-41). Stands of black spruce and tamarack were considered to have reached old growth at 140 years (pg. 3-42). The AVI attribute used to determine age is forest stand origin (Section 4.2.5, pg. 4-12). Early, young, mature, and old growth stand age classes for dominant tree species are given in Table 3.3-7, pg. 3-42. **Why was old growth attributes of stands within the LSAs not verified in the field or derived from vegetation plot data? Please verify with field or AVI data that old growth characteristics (snags, downed logs, canopy gaps, etc.) are correlated with areas modeled as old growth forest.**

The estimate of old growth forests in the RSA is based on mid-point age values of forest types within Alberta following Andison (2003, website) (Section 3.4.3.1, Table 3.4-10, pg. 3-69). The spatial distribution of old growth forest in the RSA cannot be determined from this estimate. For a spatial approximation of old growth forest in the RSA, please consider using the Alberta government spatial data from the Historical Wildfire Database (GoA 2009) as an estimate of forest stand age. The date of the wildfire can be used as a date of origin for the forest stand.

8) **Issue:** Did not account for season and whether any of the traditional use plants were restricted to a limited number of vegetation types
Reference: TES- Appendix K: Tables K-2, K-3, K-4, K-5, K-6, K-7, K-9
Concern: The selection of traditional use plants was based on consultation with elders of Fort McKay and referring to traditional plant use studies in the Oil Sands Region. The ranking of LSA vegetation types (ecosite phases and wetland types) for traditional plant potential was problematic in two ways. First, vegetation types were ranked for traditional plant potential based on the summed score of traditional plant abundances: high total scores >30; moderate scores between 20 and 30; low scores <20, without taking into account season and whether any of the traditional use plants were restricted to a limited number of vegetation types. For example, cloudberry (*Rubus chamaemorus*) is found in only four wetland types: BTNI (wooded bog with internal lawns); BTNR (wooded bog with internal lawns and islands of forested peat plateau); BTNN (wooded bog); and FTNR (wooded fen). These wetland types are either ranked low or moderate for traditional plant potential, not reflective of their high potential as sources of cloudberries. When cloudberry fruit are ripe, these wetland types have higher importance for traditional plants than when the cloudberry plants are in flower. Second, areas frequently visited for the harvest of traditional use plants were not identified nor given higher ranking for traditional plant potential. Areas known to be of particular importance, for example, areas identified with heavy fruit production or having easy access should be ranked higher for traditional plant potential. **Please identify areas in the RSA and LSA that are particularly important for traditional plant harvest by season.**

9) **Issue:** Lack of Links to TR
Reference: Throughout
Concern: The relationship of rare plants, rare plant potential, plant species diversity and richness, and old growth forest to TR was not discussed in the EIA. Although riparian communities were not discussed in relation to TR, potential riparian habitat includes ecosite phases e1, e2, e3, f2, which rank high for traditional plant use potential. In addition, riparian communities line waterways, traditional transportation corridors through the boreal forest.

3.2.2.4 Quantitative Monitoring and Using Targets

Please see the discussion in Section 3.5.2.4 of this report for a review of vegetation monitoring.

3.2.2.5 Addressing Stakeholder Concerns

TR were discussed relative to traditional plant potential and KIR lichen Jack pine communities. **We recommend that the Proponent identifies specific areas in the LSA and RSA that are of particular importance for TR.**

3.2.3 Biodiversity

Key Findings: No baseline information was gathered on genetic diversity for plant species. The results of the species diversity assessment are too general. Moreover, the calculations of biodiversity potential and the understanding of changes in landscape metrics make it impossible to interpret the significance of changes to species diversity and ecological functions. The biodiversity analyses are not useful foundations for impact predictions or benchmarks for monitoring biodiversity.

3.2.3.1 Adequacy of Baseline for Benchmarks

Genetic Diversity: No baseline information was gathered on genetic diversity (allelic diversity within and among populations, presence of rare alleles) – all very important aspects of biodiversity. Current theory holds that genetic variation is the basis for evolution, disease resistance, and adaptation to a changing environment. The Proponent states "*Little information exists concerning genetic diversity of species in the Oil Sands Region; therefore, it is not addressed in this biodiversity environmental setting report*" (TES-Section 6.1, pg 6-1). Although measures of genetic diversity on populations of vertebrate species with large ranges may be beyond the capability of an Oil Sands EIA, genetic diversity measures on representative plant and invertebrate species within the LSA would be desirable to evaluate local and cumulative impacts on biodiversity. The genetic diversity baseline information is not adequate to be used as a foundation for impact predictions or as a benchmark for monitoring programs.

Include baseline measures of genetic diversity on plant species within the LSA. Woody plants are likely to be more diverse and have larger population sizes than herbaceous plants, particularly annual or selfing taxa. Select representative species with different modes of reproduction. Genetic diversity measures could include allozymes or DNA markers (RAPD, AFLP, ISSR) (Nybom 2004) and follow guidelines suggested by ASRD (2009).

Species Diversity: Demographic structure, population structure, number of offspring and life cycle of species were not dealt with in this EIA because of lack of data (TES- Section 6.4.1, pg. 6-90). The species-level diversity assessment addressed baseline abundances (number of individuals in a population), distributions, and habitat specificity of selected taxa within separate EIA components: aquatics, wildlife and vegetation. Abundance and distribution of wildlife and fish species were estimated by the density of KIR and species of concern and relied strongly on the literature and professional opinion. The results of the species diversity assessment are too general to be used as a foundation for impact predictions or as a benchmark for monitoring programs.

Ecosystem Diversity: The ecosystem diversity assessment is based on ecodistricts and regional land cover classes in the RSA, and at a finer scale, on ecosite phases and wetland types in the LSAs (TES-, Appendix X, Section 5). The ecosystem diversity assessment ranked ecosite phases and wetland types in the Oil Sands Region using five biodiversity indices: rare vegetation type; total species richness (vegetation and wildlife); species overlap (vegetation and wildlife); rare species potential (vegetation and wildlife), and structural complexity (vegetation) (TES-Table 6.3-2, pg. 6-6). The scores for the biodiversity indices were summed across ecosite phases and wetland types in the Oil Sands Region to derive an overall biodiversity potential rank (high, moderate, or low) for each ecosite phase and wetland type. The biodiversity potential was then applied to the vegetation types within the LSAs (TES- Table X-14, pg. X-34). Landcovers of the RSA were ranked for biodiversity potential based on the weighted rank of their corresponding vegetation types (TES- Section 5, X-6). The biodiversity potential is an attempt to quantify the complex ecological interactions within and among ecosite phases and wetland types in order to rank a vegetation community's relative contribution to biodiversity in the LSAs and RSAs for decision making purposes. In addition, the five biodiversity indices are themselves simplifications of ecological complexities. Although Shell recognizes that the contribution of the individual biodiversity indices must be considered (TES- pg. X-35), there is danger that the indices will be ignored because the biodiversity potential is simply easier to consider. The biodiversity potential is not adequate as a foundation for impact predictions to overall biodiversity or as a benchmark for monitoring programs. Furthermore, there is no verification of the biodiversity potential since there is no verification of the contributing indices.

Landscape Diversity: Landscape diversity is a term associated with the composition and pattern of patch types (landscape units). Landscape diversity in the RSA relates to the relatively coarse scale composition and pattern of land cover classes, whereas landscape diversity in the LSAs focuses on the finer scale composition and pattern of ecosite phases and wetland types. The composition and pattern of the landscape has implications for ecosystem function at various scales, some of which are addressed in this EIA. The impact predictions on changes to landscape metrics are good if the impact predictions on changes to vegetation communities are good (assuming successful reclamation). However, because of the difficulties in interpreting the significance of changes in landscape metrics to species diversity and ecological functions, the measures are not good foundations for impact predictions or benchmarks for monitoring biodiversity.

Specific Concerns and Requests

1) **Issue:** Lack Verification with Field Data
   Reference: TES- Table 3.5-10, pg. 3-105; Table 3.6-9, pg. 3-166; Figures 3.5-7, 8, and 9, pg. 106-108; Figures 3.6-7, 8, and 9, pg. 168-170
   Concern: Means and standard errors, trends, and confidence intervals were not discussed in the baseline biodiversity section, except for descriptive statistics for species richness (Table 3.5-10, pg. 3-105; Table 3.6-9, pg. 3-166; Figures 3.5-7, 8, and 9, pg. 106-108; Figures 3.6-7, 8, and 9, pg. 168-170). **Please provide this information**. Modeled indices for biodiversity parameters were not verified with field data. However, sample sizes for vegetation surveys in the LSAs (aerial, detailed plots, and rare plant) were provided (Table 3.5-1, pg. 3-78; Table 3.6-1, pg. 3-139).

2) **Issue:** Lack of Details Provided
   Reference: TES- Biodiversity
   Request: Provide the relative abundance of vegetation types used in the rare vegetation type index.

3.2.3.2 Quantitative Data Collection and Analysis

1) **Issue:** Indices
   Reference: TES- Ecosystem Diversity
   Concern: A rarity of vegetation type index was used to score vegetation types as highly abundant, moderately abundant, uncommon, or rare to assess rare vegetation types. A simpler measure of vegetation type rarity, such as % of total area, would allow a more straightforward quantitative analysis of rare vegetation types. **Would the Proponent consider using % total area?**

   Because of the unevenness of sample size across vegetation types, total species richness values of vegetation types could change with future analyses, simply due to changes in sample size. This is

most likely to occur if the poorly sampled vegetation types gain additional plot information. In addition, it would be more precise to exclude vegetation types that lack plot data entirely from the analysis, considering them as unknown for species richness.

2) **Issue:** No Verification of Landscape Metric Predictions
Reference: TES- Appendix J
Concern: Quantifying landscape diversity in the RSA and LSAs involved calculations using landscape metrics. Methods of calculation and the biological interpretation of the metrics used in this EIA are provided in Appendix J. Since landscape metrics are calculations of patch geometry and spatial relationships of land cover classes in the RSA, ecosite phases and wetland types in the LSAs, old growth forest in the LSAs, and riparian communities in the LSAs and RSA, data collection is related only to the data used for producing these classification maps. See Vegetation Section 3.2.2 for details concerning data collection for the land cover map of the RSA, vegetation type maps of the LSAs, and AVI maps of the LSA. The landscape metrics themselves were calculated in a manner that will allow rigorous quantitative analyses. However, no verifications of the landscape metric predictions were carried out in the field, such as testing whether there is a correlation between metric calculations and species richness. **Why was no verification completed?**

3) **Issue:** Lack of Information
Reference: TES- Appendix X - *Rare vegetation types*
Concern: Ecosite phases and wetland types were given a rarity score based on their relative abundance in over 1500 plots within 15 LSAs of the Oil Sands Region (Appendix X: Section 2.3.1.1, pg. X-9; Section 3.1, Table X-4, pg. X-17). Scores for rarity were determined by natural breaks in the data and weighted by professional opinion as follows: highly abundant, vegetation type >10% of the total area = 0; moderately abundant, 3 to 10% = 2; uncommon, 0.25 to 3% = 4; rare, <0.25% = 6 (Section 2.3.1, pg. X-10 and Table X-4, pg. X-8). Sampling was based on available data. An assumption is that the 15 sampled LSAs correspond to random samples in the Oil Sand Region. **Please provide the raw or summarized data used in the rarity scoring.**

4) **Issue:** Lack of Information
Reference: TES- Appendix X
Concern: Total species richness among ecosite phases and wetland types was estimated for wildlife and vegetation differently. Total species richness among vegetation types is based on LSA plot data and other vegetation surveys in the Oil Sands Region. This data does not appear to be provided, but rather is referenced as being in Golder's vegetation databases (Section 2.2.3.1, pg. X-10). **Please recommend that Shell provide the data**. In general, species richness increases with sample number until reaching an asymptote, indicating the amount of sampling effort needed to approach the "true" species richness value. Since sample numbers were uneven among vegetation types in this EIA, poorly sampled vegetation types will underestimate actual species richness. Furthermore, when no plot data was available, species richness was estimated by inference from similar vegetation types,

an assumption that may or may not be valid. **Please discuss how these factors will impact the biodiversity assessment**. The summarized data used for the plant species richness analysis are provided in Appendix X (Table X-5, pg. X-20). A chart of the number of plant species per number of plots (data from Table X-5, pg. X-20) shows that an asymptote is approached when more than 50 plots are sampled per vegetation type (see Figure 3-1).

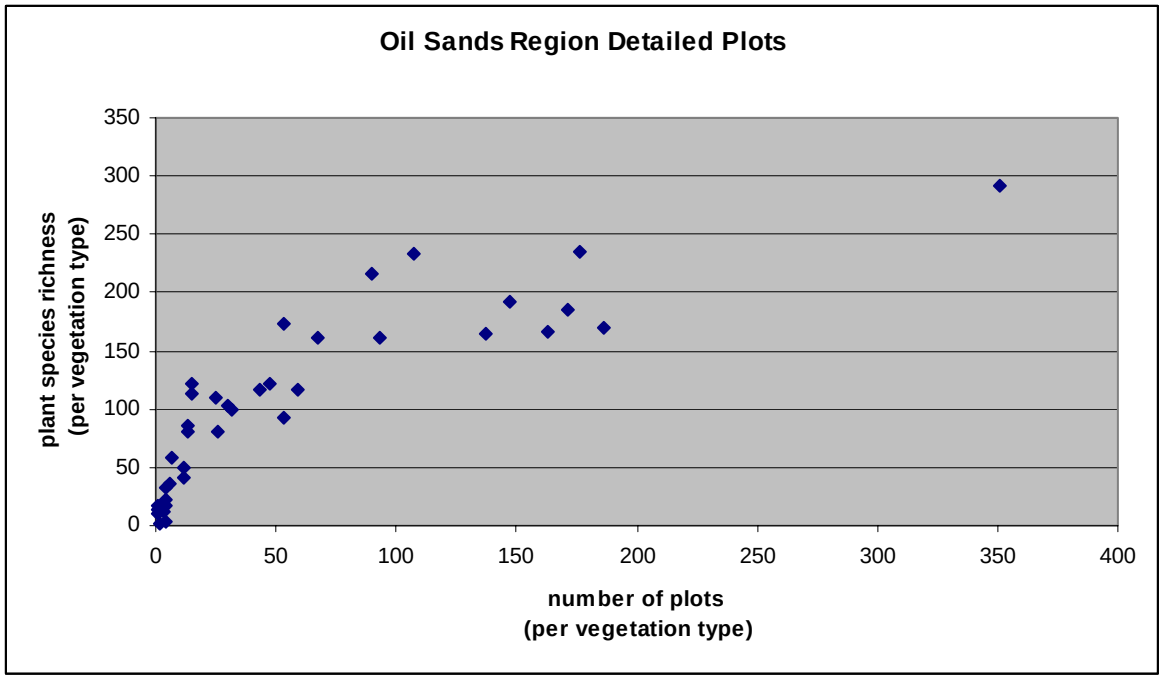


Figure 3-1: Plant Species Richness by Number of Plots

5) **Issue:** Ranking Poorly Sampled Wetlands
Reference: TES Section 6.3.1.3, Appendix X
Concern: Species overlap is a measure of the proportion of species in an ecosite phase or wetland type also found in other vegetation types (Section 6.3.1.3, pg. 6-6). It is meant to identify those vegetation types that provide for the highest number of species with restricted habitats. The species overlap parameter is calculated differently for plants and wildlife. For vascular and non-vascular plant species overlap, ecosite phases and wetland types are ranked by the number of vascular and non-vascular species shared with other ecosite phases or wetland types. Vegetation types are ranked for overlap depending on the percent total species shared with four or more other vegetation types as follows: 0 = 100% species shared; 1 = 90 to 99.9% species shared; 2 = 75 to 89.9% species shared; 3 = 50 – 74.9% species shared; and 4 = < 50% species shared (Table X-2, pg. X-8). Wetland types with low plot sampling intensity were assigned a ranking based on the expected species overlap using ranking scores for well-sampled similar wetlands (Table X-8, pg. X-24). Twelve of 20 wetland types had low plot sampling, 5 of which were ranked as 3 (50 – 74.9% species shared) (Table X-8, pg. X-

24). **One problem with ranking poorly sampled wetlands based on similar wetlands, is that if you assume the wetlands are similar, you would need to assume that they have a relative high percentage overlap in species composition and would therefore, deserve a lower rank than 3. Please discuss.**

6) **Issue:** Assessing Variation
Reference: TES- Section 2.3.3.1
Concern: Structural complexity is a measure of the vertical layers of vascular plants within ecosite phases and wetland types (Section 2.3.3.1, pg. X-13). The assumption is that structural complexity is directly related to species diversity and abundance. Vegetation types were ranked by their number of layers as follows: 1 = herbaceous; 2 = shrub/herbaceous; 3 = single-storey stands; 3.5 = even distribution of single and multi-storey stands; 4 = multi-storey stands (Table X-2, pg. X-8). Vegetation types were ranked based on information provided by the field guide of Beckingham and Archibald (1996) and professional experience (Section 2.3.3.1, pg. X-14). **Why was plot data not utilized to determine variation within and between vegetation types?**

7) **Issue:** Lack of Details for Methods
Reference: TES – Appendix J, Section 1.2.1
Concern: The software utilized for calculating landscape metrics was FRAGSTATS Version 3 (Section 1.2.1, pg. J-4). Other details concern the methods were not presented. For example, the format (raster vs. vector) and scale (grain and extent) of the RSA and LSA base maps for the analyses are not discussed. The values for patch perimeter or edge will be higher if the base map consists of large pixels, than if the map is vector, which has effects on other metric values such as adjacency and contagion. There is no indication whether the imagery was smoothed to remove single pixels, which if not smoothed, can skew patch size statistics towards the left. In addition, the treatment of the map boundary was not discussed, which has implications for nearest neighbour calculations.

8) **Issue:** Use of Justified Biodiversity Parameters
Reference: TES- Section 3.3.5.2 and Appendix X
Concern: Biodiversity parameters at the level of species diversity are taken from vegetation, wildlife, and aquatic disciplines. The parameters of species abundance and distribution and habitat specificity are justified as measures of the species level of biodiversity. The estimations of terrestrial and aquatic vertebrate diversity potential among vegetation communities rely on the literature, as well as field work in the LSAs and RSA. Most biodiversity parameters at the ecosystem and landscape diversity level are justified. Some concerns are raised pertaining to species overlap (Ecosystem Diversity) and Core Area (Landscape Diversity).

Species overlap is meant to identify those vegetation types that provide for the highest number of species with restricted habitats. Vegetation types that support a higher proportion of specialists are

ranked higher. The parameter turned out to be fairly meaningless for wildlife species, in that all ecosite phases ranked 1 (low proportion of specialists) for wildlife species overlap (Table X-9, pg. X-25) and all wetland types ranked 1, except for four wetland types with unique species that ranked 4 and one wetland type (WONN, shallow open water) that ranked 2. This result is attributed to the fact that terrestrial wildlife species are mobile and therefore, tend to be habitat generalists. This measure does not take into account habitat preference of wildlife.

The definition of core area is problematic in this EIA; "*core area habitat is defined as the proportion of a patch type that is greater than 100 m from the edge of a different patch type*" (Section 3.3.5.2, pg. 3-35). Given that the intent is to quantify areas of intensive habitat use that may be highly sensitive to human disturbance (Section 3.3.5.2, pg. 3-35), core area delineations will depend on species behaviour and habitat preference, with the choice of 100 m from edge lacking justification. Core area is discussed in terms of natural and human disturbed areas, a much generalized description of habitat; forested and non-forested areas, as representative habitat of forest-dwelling and open-habitat species; and riparian and old growth forests, more specific habitat types, but ones that naturally are found within limited areas of the RSA. **Please address variation of seasonal use of core areas in the analysis**.

9) **Issue:** Lack of TR linkage
Reference: TES
Comment: Some of the key parameters of ecosystem and species diversity are related to TR. For example, in the analyses of vegetation and wildlife species diversity, plant and wildlife species of traditional value are included. Landscape diversity was not discussed in relation to TR. Resources traditionally used by the community of Fort McKay are listed in Table 3.3-1 (pg. 3-19 to 3-22), but there is no general TR ranking of vegetation types or land covers or maps indicating areas of overall TR importance.

3.2.3.3 Quantitative Monitoring and Using Targets

Biodiversity is an overarching issue generally raised by FNs in regard to the overall function and health of ecosystems. Monitoring biodiversity was discussed in general terms, without specifics regarding methods, analyses, or control sites. No benchmarks for reclamation or actions in the event of missed benchmarks are outlined even though Shell states "*Evaluation of biodiversity potential characterizes the environmental setting conditions to which future landscapes in the Oil Sands Region can be compared. The similarity between the pre- and post-Project landscapes can be measured using this information for directing conservation and reclamation, monitoring and adaptive management plans. These analyses provide a benchmark to compare impact values and assist in future reclamation planning*" (TES- Section 6.5, pg. 6-26).

Biodiversity potential for ecosite phases and wetland types in the LSA and land cover classes in the RSA are based on combined indices (rare vegetation type; vegetation and wildlife total species richness; vegetation and wildlife species overlap; vegetation and wildlife rare species potential; and structural complexity). Because the biodiversity potential is a sum of several biodiversity rankings, the biodiversity potential has the possibility to smooth out values of its component indices. By combining indices, the value for these different aspects of biodiversity is downplayed within the individual vegetation communities. The biodiversity potential is a poor measure to use for monitoring the complexities of biodiversity and should be avoided. **Instead, please consider protocols such as developed for the Alberta Biodiversity Monitoring Program should be considered.**

3.2.3.4 Addressing Stakeholder Concerns

Some of the key parameters of ecosystem and species diversity are related to TR. For example, in the analyses of vegetation and wildlife species diversity, plant and wildlife species of traditional value are included. Landscape diversity was not discussed in relation to TR. Resources traditionally used by the community of Fort McKay are listed in Table 3.3-1 (TES, pg. 3-19 to 3-22), but there is no general TR ranking of vegetation types or land covers or maps indicating areas of overall TR importance.

3.3 Aquatic Resources

3.3.1 Hydrogeology

Key Findings: The approach taken by the EIA did not involve regional and cumulative classification of hydrogeological impacts; this is not consistent with the EIA ToR. No solute transport modeling of regional groundwater flow was carried out to assess cumulative effects of the Project on regional groundwater quality. The peak impacts of degraded groundwater quality discharging to surface water systems potentially affecting TR in the LSAs were not determined.

3.3.1.1 General Comments

Activities associated with open pit oil sands mines that have the potential to effect groundwater flow directions, groundwater quantity, and groundwater quality typically includes:

- excavation, backfilling, and reclamation of mine pits;
- disposal of tailings outside mine pit limits;
- dewatering and excavation of overburden materials, in this case including a Pleistocene Channel aquifer located within the JEMA lease boundaries;
- depressurization of the Basal McMurray Formation aquifer (Basal Aquifer) for mine pit stability;

- plant facilities; and
- use of groundwater for water supply.

The approach taken by the EIA did not involve classification of hydrogeological impacts. Rather, the impacts caused by mining activities on groundwater resources were used to assess the impacts to humans, wildlife, and aquatic life due to decreased baseflow from groundwater discharge to surface water, and degraded groundwater quality and its effects on surface water quality. This approach does not appear to be consistent with the EIA ToR, which state that the EIA will present project impacts, including cumulative effects. The proposed projects clearly have major, negative, and irreversible hydrogeologic impacts such as the destruction of portions of a Pleistocene Channel aquifer (Kearl Channel), which will be dewatered and stripped as overburden to access bitumen. **Why did the EIA not comply with the Terms of Reference and clearly identify Project impacts to hydrogeology, including major, negative irreversible impacts such as dewatering and excavation of portions of the Kearl Channel aquifer?**

The most significant hydrogeologic impacts, aside from the excavation of surficial aquifers, involves relatively widespread degradation of groundwater quality due to tailings disposal and significant drawdowns due to dewatering of surficial aquifers and depressurization of the Basal Aquifer of the McMurray Formation. Aquifer drawdown is largely a reversible process after cessation of mining activities. However, groundwater quality will continue to degrade surface water quality beyond the temporal boundaries of 100 years after completion of mining established for the EIA. **Why were the peak impacts of degraded groundwater quality discharging to surface water systems in the local study areas not determined in the EIA?**

3.3.1.2 Adequacy of Baseline for Benchmarks

The water quality characterization for the hydrogeologic regime in the JEMA LSA was based on a monitoring well network that was established in all significant water-bearing zones including, from surface downwards, shallow and deep Quaternary deposits including the Pleistocene Channel aquifer, the Basal McMurray aquifer, and Devonian Waterways Formation. The collected data represent an extensive water quality database that is considered adequate for characterization of baseline groundwater quality conditions for the purpose of conducting an EIA. The stratigraphy and groundwater flow regime in the vicinity of the JEMA appears to be well understood and the level of characterization is considered adequate as a basis for predicting impacts from the proposed mining operations.

Two fens referred to as the Patterned Fen and the Lenticular Fen were identified in the northeast corner of the lease boundaries for the JEMA. Fens are wetland features characterized by a high water table and more mineral rich water than peat bogs. It was inferred that there was likely to be a strong

hydraulic interaction between the fens and deeper groundwater aquifers, although a lack of nested monitoring wells near the fens precluded determining if the fens constitute zones of groundwater discharge or recharge. **Please discuss why more sampling was not conducted in these areas.**

The water quality characterization of the hydrogeologic regime in the PRMA LSA was based on a monitoring well network that was established in all significant water-bearing zones including, from surface downwards, shallow Quaternary deposits (10 monitoring wells), deep Quaternary deposits (four monitoring wells), the Basal Aquifer (nine monitoring wells) and Devonian Waterways Formation (two monitoring wells). The collected data is considered adequate for characterization of baseline groundwater quality conditions for the purpose of conducting an EIA. No data from surrounding projects was used in characterizing the baseline hydrogeological conditions within the PRMA LSA. The stratigraphy and groundwater flow regime in the vicinity of the PRMA and the level of characterization is considered adequate as a basis for predicting impacts from the proposed mining operations.

The Eymundson Sinkholes Environmentally Significant Area (ESA) is an area of sinkhole lakes located in the eastern portion of Lease 9. Sinkholes may occur when soluble rocks (carbonates and evaporates) dissolve and collapse. It is understood that the ESA was defined as to limit disturbance near the lakes, which were identified as a "rare feature in Alberta". The concern was disturbance near the lakes could affect aquifers that supply the sinkholes. The interpretation of water level data for the PRMA indicated that the sinkhole lakes exhibited no marked influence on the groundwater flow system in the ESA.

3.3.1.3 Quantitative Data Collection and Analysis

The hydrogeologic component of the EIA describes the hydrogeology of the local and regional study areas in a generally satisfactory manner. The hydrogeologic database compiled for the EIA RSA and separate LSAs was used to develop three groundwater models: 1) a model of the RSA used to simulate Basal Aquifer depressurization and overburden dewatering for the Base, Application, and Planned Developments cases; 2) a local scale model of the JEMA LSA to simulate overburden dewatering, disposal of tailings outside the mine pit limits, and mine backfilling and reclamation for the Application Case; and 3) a local scale model of the PRMA to simulate overburden dewatering, external tailings disposal, and mine backfilling and reclamation for the Application Case.

The quality of the predictions developed using numerical groundwater models depends on the amount and quality of data available and used to develop the model, the computer code used to construct and run the model, and the skill and experience of the modeller. A description of how the models were developed and calibrated is provided in Appendix 4-1 of Volume 4 of the EIA. The models were constructed using the MODFLOW code for groundwater flow, which is an industry standard developed by the US Geologic Survey (USGS) and MT3D for solute transport.

Specific Comments and Requests:

1) **Issue:** No Regional Cumulative Effects Analysis (CEA) for Solute Transport
Reference: Hydrogeology
Concern: The RSA model was developed using 12 model layers to simulate the 7 principal hydrostratigraphic units from Devonian (oldest) to Quaternary (youngest). The RSA model was calibrated to static groundwater levels prior to development, groundwater discharging as baseflow to the Muskeg River, Pierre River, Big Creek and Asphalt Creek, and transient groundwater levels caused by Basal Aquifer depressurization at the Syncrude Aurora North Mine (since September 2000) and Muskeg River Mine (since March 2002). The model was calibrated to static levels measured prior to development in 101 piezometers in Quaternary deposits, 5 piezometers in McMurray Oil Sands, 154 piezometers in the Basal Aquifer and five piezometers in the Devonian formations. Based on our review, the model developed for the RSA appears suitable for use in predicting regional hydrogeological effects on groundwater quantity and flow for the Base, Application, and Planned Developments cases. There was no attempt at modeling solute transport at the regional scale and therefore no means to assess cumulative effects on groundwater quality within the RSA. **Why was no solute transport modeling of regional groundwater flow carried out to assess cumulative effects of the Project on regional groundwater quality? What are the expected cumulative effects of the Project with respect to regional groundwater quality?**

2) **Issue:** LSA Flow Model
Reference: Hydrogeology
Comment: The layering used to represent hydrostratigraphic units in the JEMA LSA and PRMA LSA were identical to those used in the regional model. The JEMA LSA flow model was calibrated to static groundwater levels in 52 Quaternary piezometers, 3 piezometers in the McMurray oil sands, and 55 piezometers in the basal aquifer. The PRMA LSA flow model was calibrated to 17 Quaternary piezometers, 1 piezometer in the McMurray oil sands, and 8 piezometers in the Basal Aquifer, as well as baseflows in the Pierre River, Big Creek and Asphalt Creek. Based on our review, the LSA flow models appear to have been carefully constructed and calibrated and should be suitable for predicting local-scale changes to groundwater flow and contaminant transport for the Application Case.

3) **Issue:** Approach to Contaminant Transport Modeling
Reference: Hydrogeology
Concern: Results of the calibrated LSA flow models were used in conjunction with the MT3D code to predict contaminant migration from areas of tailings and fluid disposal developed over the life of the mines. The approach to contaminant transport modeling involved prediction of discharge

concentrations (mg/L) and mass discharge rates (mg/s) to a series of "*water quality assessment nodes*" in the LSA models. The locations and descriptions of the assessment nodes are shown on Figure 9 in Appendix 4-1 and include locations in the Athabasca River (4 locations), Muskeg River (4 locations), Kearl Lake, Jackpine Creek, Pierre River (1 location), Big Creek (2 locations), as well as fluid cells and pit lakes in both mining areas. Discharge concentrations and rates were predicted for several times during development and closure of each mine, including a "Far Future" case taken as 100 years after the start of mine closure (2149 for the PRMA and 2165 for the JEMA). Chemical parameters used in the models consisted of six substances or class of substances that reflect a range of mobilities or degree of attenuation in the subsurface: total dissolved solids (TDS), barium, naphthenic acids, carcinogenic polycyclic aromatic hydrocarbons (Group 2 PAHs), non-carcinogenic polycyclic aromatic hydrocarbons (Group 8 PAHs), and chronic toxicity. Chronic toxicity is not a chemical substance but refers to a given water, as a whole, to result in chronic toxicity to aquatic organisms due to additive effects of contaminants (e.g., tailings water containing naphthenic acids, TDS and metals). Transport processes, including sorption and biodegradation, were used in the transport models and transport parameters were summarized in Table 12 of Appendix 4-1. No literature was cited for the source of the transport parameters, but it is very likely that laboratory-derived natural biodegradation rates for PAH parameters were used in the contaminant transport analysis (as opposed to field tests), which leading researchers (King *et al.* 1999) have concluded can be unreliable predictors of PAH degradation rates in the field. They also state that due to the complex nature of the PAH plumes, the extent of natural attenuation cannot be easily predicted, and that various PAH compounds have widely varying tendencies to degrade under aerobic (lab test) and anaerobic (field test) conditions. The study found that naphthalene in particular underwent only marginal rates of biodegradation during the multi-year field study. As a result, they conclude that to use natural biodegradation as a remedial strategy, field biodegradation must first be proven, and then quantified. **What was the data source for natural biodegradation rates used by the proponent in the PAH contaminant transport analysis? If the PAH natural biodegradation source data is laboratory-derived, what plans, if any, has the proponent to conduct field-based studies of natural biodegradation rates for PAH compounds?**

4) **Issue:** Assessment of Peak Concentrations and Discharge Rates is Considered Incomplete
Reference: Appendix 4-1
Concern: Results of groundwater quality discharging at the water quality assessment nodes were summarized in various formats in tabular form. Absolute discharge concentrations documented in Appendix 4-1 were not compared to any regulatory guidelines for protection of drinking water or aquatic life. For the JEMA, Table 30 in Appendix 4-1 provides a Maximum Effect Assessment listing the peak discharge concentration and year that the peak concentration will be reached for each of the six chemical substances and for all water quality assessment nodes in the JEMA. It is noted that this assessment of peak concentrations and discharge rates is considered incomplete, as a number of

parameters will peak in concentration after the time frame considered for the Far Future case. As an example, at the water quality assessment node identified as Muskeg River downstream of Jackpine Creek (M2), peak concentrations of TDS, barium, naphthenic acids, and Group 8 PAHs are all predicted to peak at times greater than 100 years after closure (i.e., the Far Future case), but the actual magnitude of peak concentrations discharging to Muskeg River relative to source concentrations in the tailings or fluid cells has not been identified.

Solute transport modeling for the PRMA followed generally similar procedures as for the JEMA, although two solute transport cases were considered:

- without mitigation measures, which reflects a worst case condition; and
- with mitigation measures, which reflect the proposed actual operating conditions as described in the EIA.

The mitigation measures described in Appendix 4-1 consisted of a series of 48 recovery wells along the north and east boundaries of the external tailings disposal area (ETDA) that would capture virtually all tailings seepage and construction of a low permeability barrier on the east side of the mine pit (closest to the Athabasca River) to minimize seepage to the river through the Quaternary deposits. Results were presented in Appendix 4-1 for the first case above but results were not tabulated for the case with mitigation measures. Absolute discharge concentrations documented in Appendix 4-1 were not compared to any regulatory guidelines for protection of drinking water or aquatic life. Table 50 provides a Maximum Effects Assessment of TDS, naphthenic acids, Group 8 PAH, and toxicity. No reason for excluding barium and Group 2 PAH was provided, although a review of the data suggests these compounds would only be expected at elevated concentrations in the pit lakes and this may be why they were excluded from the Maximum Effects Assessment. Similar to the case for PRMA, peak concentrations were not reached at a number of the water quality assessment nodes within the time scale considered for the Far Future Case. Examples include discharge of naphthenic acids and Group 8 PAH into the Athabasca River, and discharge of TDS, naphthenic acids, Group 8 PAH, and toxicity into Big Creek and tributaries.

Why was the contaminant transport model time scale not selected to include arrival of peak concentrations for all Project-related contaminants of concern at all model water quality assessment nodes? What are the predicted peak concentrations of all Project contaminants at all water quality assessment nodes?

What are the predicted impacts to groundwater quality degradation within the Fort McKay Indian Reserve No. 174C because of the proposed development of the JEMA and existing, approved, and planned oil sands projects in the area?

5) **Issue:** Incomplete Temporal Boundaries
Reference: EIA Sections 6.3.2.2 and 6.5
Concern: The EIA for hydrogeology includes a restatement of the environmental setting described previous and a description of the project effects on groundwater flow directions, groundwater levels, and solute transport in groundwater at various times for the Base Case, Application Case, and Planned Developments case. Section 6.3.2.2 indicates the "*temporal boundaries*" considered for hydrogeology under the EIA extends to a period of 100 years after the end of mining. As stated earlier, the results of solute transport modeling indicate the maximum degradation of surface water quality will occur in a number of instances beyond the Far Future scenario considered in the models. **Again, why is it considered acceptable to establish the temporal boundaries for the EIA within a time frame that will not realize the maximum predicted impacts to water quality degradation?**

3.3.1.4 Quantitative Monitoring and Using Targets

The proposed hydrogeological monitoring program is described in Volume 4, Appendix 4-9, Section 2. The monitoring plan is described as a "conceptual" plan with a more detailed plan to be developed in consultation with regulators and stakeholders following project approval.

The monitoring plan describes the objectives of the monitoring program, the parameters to be monitored and analyzed, and the frequency of monitoring. The monitoring program is to involve measurement of groundwater levels and groundwater quality to assess changes that occur due to:

- Basal Aquifer depressurization;
- overburden dewatering;
- external tailings disposal;
- pit backfilling and reclamation; and
- plant facilities.

Table 1 of the monitoring plan defines the parameters to be analyzed and Table 2 defines the monitoring schedule. The list of analytical parameters and monitoring schedule appear to be appropriate for assessing changes to groundwater quality associated with mining and processing oil sands and disposal of tailings.

As the monitoring plan is a conceptual plan without details on the proposed number, depths, and locations of monitoring wells, what opportunity will the local FNs have to review and comment on the final plan if the project receives approval?

3.3.1.5 Addressing Stakeholder Concerns

With only a conceptual plan for groundwater monitoring in place, it is unclear how Shell will monitor impacts to the near-surface water table, related surface ecology, and the value of potable groundwater resources. Generally, the use of near-surface, potable Quaternary aquifer groundwater for both project utility use and make-up water use are often poorly assessed. Given that TR are connected to groundwater conditions, Shell should consider linking potential Project impacts to hydrological systems and traditional resource use. It appears that rather than directly discussing the link between hydrological systems and TR, Shell directs readers to hydrology and fish sections (EIA Section 6.3.4).

3.3.2 Hydrology

Key Findings: Justification of predicted impacts is possibly misconstrued because it is based on data from watersheds with different characteristics. Declining trends of streamflow in the Athabasca River are dismissed in the impact predictions. An oil spill dispersion study was not carried out. The assumption that reconstructed soils and vegetation are identical to baseline watershed conditions was never demonstrated and is likely wrong. Mikisew Cree concerns about water have not been addressed.

3.3.2.1 General Comments

Rather than reporting on a complete review of all aspects of surface water hydrology related issues, this review is carried out with Mikisew Cree's major concerns regarding water quantity in mind, which include:

a) that the proposed project is implemented in such a way as to allow sustainable development, so that the environment is preserved to enable the Mikisew Cree to continue their practice of Treaty Rights;
b) that water allocations are not increased;
c) that in-stream flow needs, set by Alberta Environment, are honoured, with the consequence that water withdrawals are reduced or stopped should the streamflow fall below set threshold values (yellow and red zones of the water management framework);
d) that the risk of accidental spillages is kept low, and that the spread of a contaminant is understood based on scientific field experiments and transparent modeling, and that adequate mitigation measures are in place in order to avoid a contaminant from reaching the lower reaches of the Athabasca River or Lake Athabasca;
e) that the method of storing thickened tailings in tailings ponds is not applied in new oil sands mining projects and is replaced with technology that results in stackable tailings, thus eliminating the need for new tailings ponds;

f) that the reclamation efforts are based on proven science in order to guarantee a successful and timely conversion of the land to a functioning and self-healing landscape similar in function and habitat to what it was during pre-development conditions;

g) that all hydrological analyses are based on the best available science and include cumulative effects, climate change, updated data records, trends, and meaningful risk analyses; and

h) that the information on water and water management is complete and transparent, so that the Mikisew Cree and other Albertans can understand all assumptions, statistics, modeling approaches, and associated uncertainties.

The report is, in part, comprehensive, integrating a wide range of partly high quality data. This is acknowledged. It is also recognized that Shell has committed to honour the withdrawal restrictions and is committed to respect the in-stream flow needs Water management Framework in Volume 4A, Section 6.4.7.3, where Shell states to "*follow the water withdrawal limits prescribed by the Water Management Framework*".

However, there are major issues with the EIA, which have a direct consequence on the impact evaluations. Important concerns expressed in previous and similar EIAs are not incorporated, uncertainties of reported environmental effects are generally not provided, and available alternative technologies, such as stackable tailings, are not even mentioned. As a consequence, **we recommend that the Mikisew Cree propose that regulators withhold the approval until the deficiencies of the project and EIA are eliminated.** We illustrate some of these overarching concerns in the following sections.

Tailings Dams

Major tailings dams and EPL are planned. As both ETDA and EPL are yet unproven technologies, significant adverse long-term environmental impacts are possible. According to the Canadian National Energy Board (2004), there is no demonstrated means to reclaim fluid fine tailings. There is also considerable doubt that the EPL concept will work as hoped. Both ETDAs and EPLs can lead to significant litigious, liability, regulatory, and reputational risk. Therefore, emerging technologies that have the potential for reducing the environmental footprint and reducing the risk of unknown impacts and associated asset retirement obligations should be embraced.

The production of dry stackable tailings through centrifuging of tailings or chemical treatments are potential solutions to reduce environmental and obligatory risk. One technique to produce dry stackable tailings is the proven Bitumen process, which reduces water demand, reduces CO_2 emissions, produces backfill for instant land reclamation, thus eliminating the requirement for ETDAs and EPLs, and reducing

the final footprint of the project at closure. **Why is Shell not using dry stackable tailings as part of its commitment to BATEA?**

Trend Analyses

Climate change impacts, such as declining trends of streamflow in the Athabasca River, are analysed and reported quite extensively, and are then dismissed using arguments based on data from a watershed that has entirely different physiographic characteristics and climate. It is not clear if any trends in streamflow or air temperature detected were actually implemented in the estimation of future environmental impacts.

If statistically significant trends are detected in certain flow conditions in the Athabasca River and other rivers and streams within the project area, we recommend that the Mikisew Cree require that they be incorporated into the estimation of future streamflows and the project effects and cumulative effects analyses. Future impacts should be based on conservative or worst-case scenario conditions so as to reduce environmental and obligatory risk.

Modelling and Uncertainties

The Hydrological Simulation Program-Fortran (HSPF) model is used to simulate past, present, and future watershed conditions. Future watershed conditions will result in the significant change of some watershed parameters, such as plant interception values, infiltration rates, or soil water variables, such as field capacity, soil depth, and redistributions values, as well as groundwater recharge rates and interflow. If the HSPF model is applied under watershed conditions for which it was not calibrated, then the Proponent assumes that all of these parameters are identical in these watersheds.

Beven (2001) states that a parameter set is often only valid for the watershed conditions for which it is defined. The Proponent has used calibrated parameters for conditions that are clearly different from the calibration watershed conditions. Evapotranspiration, a major element in the hydrological cycle, which strongly influences soil moisture and watershed runoff, is not computed within HSPF from climatological variables, but is input into the model, presumably not varying between years. As evapotranspiration will change with climate change, and under newly established reclamation conditions, it is imperative that it be modelled under changing conditions.

The modelling approach is based on the assumption that an entirely newly reconstructed terrain, constructed soils, and newly planted vegetation responds hydrologically the same as a landscape that has established itself over thousands of years. The growth and spreading of the planted vegetation over the next decades, natural compaction of the reconstructed soils over time, and climate change impacts in

terms of increased potential evapotranspiration appear not have been considered. Given the rate of change in developing boreal ecosystems, the reconstructed watersheds will probably take 100 or more years for the main biotic components of the system to mature and more than 500 years for weathering and geomorphic processes (Johnson and Miyanishi 2008). However, the Proponent reports an extremely high confidence in its simulation results, where the range of predicted streamflow statistics is less than half a percent. Findings from research from established reclamation plots should be reported and incorporated in the model.

Generally, only mean streamflows and 10-year return periods are reported to form the basis for impacts assessment, but this is inadequate. McCuen (1973) states that the selection of an objective function is very important, and therefore, that the objective function selected should reflect adequately the intended hydrological characteristic. For example, an objective function that only reflects the mean change in simulated streamflow may indicate small future differences, when, in fact, future streamflows have a larger standard deviation of the runoff, producing increased peak flows and decreased low flows.

Based on the HSPF modelling approach and the unrealistically small range in upper and lower confidence levels reported, simulation results cannot be accepted in their current form.

Cumulative Effects and Research

The Proponent states (Volume 4A, Section 1.3.2): "*the use of appropriate predictive tools and methods consistent with CEMA, WBEA, RAMP and CONRAD and any other relevant regional initiatives, to enable quantitative estimates of future conditions with the highest possible degree of certainty*". The Surface Water Working Group of the CEMA, a multi-stakeholder organization established to provide effective regional environmental guidelines, objectives and thresholds, is frequently cited as a data source, a management framework, and a source to identify major concerns. It is disturbing that CEMA itself noted that "there are currently no collaborative water-related research projects being undertaken by the industry" (Council of Canadian Academies 2009). According to Kennett (2007), participants in CEMA from the federal government, Aboriginal organizations, and environmental non-governmental organizations have raised concerns about the slow progress of CEMA in achieving tangible results, that significant gaps remain, and that CEMA has consistently failed to meet time lines for key deliverables. In summary, CEMA is failing its mandate to provide a sound management framework for the water resources in the oil sands region and to establish relevant environmental capacity guidelines. Further, the Regional Sustainable Development Strategy for the Athabasca Oil Sands Area, initiated by the (GoA) and released in 1999, has not been updated, in spite of the enormous and unexpected number of oil sands projects approved or applied since then.

We recommend that the Mikisew Cree request a mandatory commitment of existing, approved, and proposed oil sands projects to participate in collaborative water-related research projects to evaluate the cumulative effects of current, approved, and planned oil sands projects in Northern Alberta. Research projects should include:

- **cumulative effects on groundwater with associated effects on local wetlands, lakes, streams, and rivers;**
- **an oil spill dispersion analysis for the Athabasca River;**
- **cumulative effects of oil spills and leakages on the Athabasca River and water bodies downstream of the Embarras; and**
- **water balance analyses for each specific landscape unit with a unique land cover – soil – climate characteristic, with particular focus on reconstructed landscape units, so as to optimize conditions for successful reclamation.**

Tailings dams can leak 1000s of m^3 daily into the Athabasca River and oil spills in inland waterways can have enormous environmental and economical impacts (Yapa and Shen 1994). Tailing ponds contain naphthenic acids, a toxic and corrosive pollutant produced in large quantities by oil sands refining. These acids are persistent in water but their occurrence and fate have been sparsely studied (Headley and McMartin 2004). It is acknowledged and appreciated that an Athabasca River Model exists to simulate spillages (not mentioned in the EIA under review). However, any model application needs to undergo a reality check by comparing simulated results against observed results, especially when the environmental risk can be enormous. **Therefore, we recommend that the Mikisew Cree request, in the name of public interest, that an oil spill dispersion study be carried out, in addition to dispersion modelling, by the Proponent, with the collaboration of other oil sands operators.** This would be a pro-active and prudent effort to enable the better protection of the aquatic environment of the Athabasca River and Lake Athabasca, downstream of the oil sands operations. It is important that the oil spill dispersion analyses be transparent and that all relevant data and results be made available to Albertans. Analyses must be carried out for the full range of streamflow conditions, from low flow conditions, to mean or median runoff, to conditions found during the spring flood. Analyses must also be carried out for different spillage volumes and a range of representative substances that could be spilled during normal and worst-case flooding conditions. The benefits of these analyses are that:

- spill responses can be carried out more effectively, thus minimizing the environmental impacts;
- locations for containment can be identified, and containment equipment can be stored at those locations to speed up the response time and minimize the environmental effects; and
- the baseline study area can be delineated based on scientific data rather than on simple assumptions.

3.3.2.2 Adequacy of Baseline for Benchmarks

While a lot of data and analyses are reported, there are some deficiencies. At least one very relevant report was ignored. Some assumptions are not explained or are missing a scientific basis. Other data reported are contradictory and need either further explanation, or corrections.

The Proponent plans to create new ETDAs with a very large combined surface area. With the implementation of Directive 074 by the ERCB, two new requirements must be met by the Proponent:

- Dedicated Disposal Areas must be created to dump fine sediments, which are removed from the fluid tailings waste, and
- a detailed tailings management plan must be submitted, including the condition of the tailings to be trafficable for closure and reclamation. According to the directive, trafficable means that all water has been removed from the pond and the sediments and fine materials have consolidated to form a hard surface on which vehicles can operate.

Based on the new directive, the proposed project cannot be approved without submissions of updated plans to fulfill Directive 074 by the ERCB. Irrespective of the directive, the use of ETDAs must be avoided for three reasons:

- ETDAs are still unproven technology, where the time of consolidation is unknown and the trafficability at the end of consolidation is also unknown;
- there is a potential that ETDAs remain toxic waste dumps for a very long time, well beyond the project life time, and liability issues need to be resolved;
- although CEMA maintains an EPL Subgroup, the concept of EPLs is currently unproven, where the migration of toxins into the water and the eventual water quality of the EPLs remain unknown; and
- ETDAs require a very large area that changes the original landscape, with currently unknown long-term effects on the environment.

Alternatives to ETDAs and EPLs are available which would avoid major environmental problems and reduce uncertainties.

Specific Comments and Requests:

1) **Issue:** Updated EIA Report is Incomplete
Reference: Volume 4A, Section 6.1.3
Concern: It is recognized that the report entitled "State of the Muskeg River Watershed Report", published in July 2008 (Dillon Consulting Ltd), was not available at the time of the release of the EIA. However, this report was available for the revision to the EIA from May 30, 2008. Therefore, the EIA is outdated and should be updated. **As the above mentioned report includes data and analyses not included in the EIA, it is requested that the findings are integrated or amended into the EIA.**

2) **Issue:** Muskeg Drainage
Reference: Volume 4A, Section 6.4.2.5
Concern: A drainage water yield for muskeg of 0.6 times thickness is reported and used to estimate the water yield. **Please provide the data, publication, and scientific rationale for the factor 0.6 used in the equation.**

3) **Issue:** Runoff Coefficients for JEMA and PRMA
Reference: Volume 4A, Section 6.4.2.5
Concern: It is stated that "Water yield in the second year of drainage is 0.2D plus 0.120 m from precipitation for JEMA and 0.060 m from precipitation for PRMA during the six-month open-water season." **Please provide an explanation as to why the runoff produced by precipitation is twice as high in JEMA as in PRMA.**

4) **Issue:** Precipitation Depth
Reference: Volume 4A, Section 6.4.3
Concern: It is reported that the mean annual precipitation for JEMA is 433 mm and 374 mm for PRMA. Using PRISM precipitation surfaces (Daly *et al.* 2002); the mean annual precipitation (1971-2000) is 466 mm for JEMA and 533 mm for PRMA. This would be expected, as the mean elevation of PRMA is higher than JEMA. As precipitation is the most important hydrological variable, it is essential to use realistic precipitation values. Therefore, impact predictions using too low precipitation values in the simulations are highly questionable. **Please provide a scientific rationale and data sources for the reported mean annual precipitation value at PRMA.**

5) **Issue:** Runoff Depth
Reference: Volume 4A, Section 6.4.3
Concern: Mean annual runoff depths of 81 to 107 mm for JEMA and 24 to 81 mm for PRMA are reported. It is important to understand the watershed behaviour for impacts analyses and simulation purposes. When runoff depths of this magnitude are observed, and potential evapotranspiration rates are assumed to be similar in magnitude, the reason for the large difference in runoff depths must be either vegetation or soils or a combination of both. **Please provide a scientific**

explanation for the wide range of runoff depths reported. Please provide information on how the noticeable difference in watershed characteristics is reflected in the parameters for hydrological simulation.

6) **Issue:** 100-year flood
Reference: Volume 4A, Section 6.4.3, Tables 6.4-2, 6.4-3 and 6.4-4
Concern: Only the 10-year flood is reported. This return period is not meaningful. In most statistical predictions, the 95% confidence level is applied. Here, the 95% confidence level can be translated as: "What is the low (or high) flow level that is non-exceeded (exceeded) 95% of the time?" Using standard return-period statistics, the 5% risk of a low (or high) flow being non-exceeded (exceeded) for a 39-year and 53-year period is 760 years and 1034 years respectively. Values for the flow extremes should be calculated based on those values, rather than the 10-year return period, which has an over 98% probability of occurring during the life time of the projects, and therefore, is not meaningful to describe extreme flow conditions. **Please provide the magnitude of the 100-year flood, as well as the 760-year (for PRMA) and 1034-year flood (for JEMA) for the watersheds under investigation.**

7) **Issue:** Kearl Lake Water Balance
Reference: Volume 4A, Section 6.4.3, Table 6.4-3
Concern: Table 6.4-3 lists a mean annual lake inflow of 0.27 m^3s^{-1} and a mean annual lake outflow of 0.24 m^3s^{-1}. The difference between lake inflow and lake outflow must be due to lake evaporation. The difference of 0.03 m^3s^{-1} is equivalent to 172 mm $year^{-1}$, which is significantly less than the lake evaporation reported in Section 6.4.3 of 592 mm. The only other factor could be seepage, which is not reported. **As reported, the Kearl Lake water balance does not balance. Please provide the scientific rationale for the reported values.**

8) **Issue:** Trend in Air Temperature
Reference: Appendix 3, Section 6.3.2
Concern: Elaborate trend analyses were carried out. The Proponent reported a significant positive trend of mean annual, monthly, and seasonal temperatures, with the exception of the fall months. It is stated: "*Based on a trend line fitted to recorded data, the forecasted mean annual air temperature at the Fort McMurray Airport and Whitecourt Airport Stations will increase by 3.1 and 5.6°C, respectively, by the year 2050, compared to the 1961 to 1990 temperature normal.*" What the Proponent meant was that the air temperatures will increase by 2.79 and 3.68°C to 3.06 and 5.57°C. The issue is that the consequence of the temperature trends on watershed hydrology and reclamation is not used for the impacts analyses. **Please provide information on the consequences of the reported positive trend in air temperature in terms of the hydrology during the life time of the project and future reclamation efforts at the end of the project. Please specify how the trend in air temperature will change the snow-to-rain ratio over the life time of the**

project and also specify the anticipated associated effects on the streamflow regime in the project area.

3.3.2.3 Quantitative Data Collection and Analysis

The modelling philosophy of using a calibrated HSPF model on physiographically very different watersheds is invalid for impacts assessments, if the watershed variables and parameters that represent the various watershed characteristics for present and, in particular, future conditions are not presented and discussed in detail. A model that reportedly does not change in output when input variables are changed should not be chosen and should be replaced with a model that is particularly sensitive to variables that will change in the future, especially where large portions of watersheds are completely reconstructed.

Specific Comments and Requests:

1) **Issue:** Prediction Confidence
Reference: Volume 4A, Section 6.4.5.3, Tables 6.4-14 and 6.4-25
Concern: The results of modelling uncertainty analysis show extremely small differences between the lower and upper 95% confidence limits for mean annual flow, 10-year flood flow, and 7Q10 low flow. The differences are 0.12%, 0.35%, and 0.42% respectively. The reported modelling uncertainty analysis was for the Muskeg River at the Mouth for the Application Case Closure time snapshot.

There are many major uncertainties that may have an impact on future streamflows, including:

- reported trends in streamflow and air temperature;
- major uncertainties with regard to climate change; and
- major changes in watershed characteristics.

Hydrological forecasting is, by nature, an uncertain science, simply because the data bases are generally poor (both in terms of temporal and spatial representation) and every single hydrological variable is very difficult to measure.

Considering those uncertainties, it is not logical to simulate future streamflows at the reported confidence levels. This suggests that either the modelling philosophy is wrong, or the model is wrong, or the model variables/parameters are wrong.

The Proponent states numerous times the uncertainties of data. For example:

- Page 6-330: "To ensure development of a long-term self-sustaining landscape after closure, future studies should be done to provide detailed design criteria for final design of the

reclamation system and to allow for accurate prediction of the performance of the closure system".

- Page 6-345, on prediction confidence in the Athabasca River: "Potential flow decreases are uncertain. The uncertainty in these estimates would constitute a major portion of the uncertainty in predicted changes in flows."
- Page 6-344, on prediction confidence of flow data: "The discharge data are estimated to be accurate to about ± 5% for most flows, and from ±10% to ±20% for low and flood flows."
- Stated in Suncor Energy Inc. Voyageur Project (2005), and Imperial Oil Kearl Oil Sands Project (2005): "Given the limited input data for watersheds and the lack of an extensive body of knowledge on hydrologic processes in the Oil Sands Region, it is difficult to establish probabilistic models that will include all these characteristics for defining uncertainties associated with model parameters and, particularly, for input data such as precipitation and temperature."

There is a contradiction between the correctly reported uncertainties and the simulated prediction confidence. The statement is made that the reported prediction confidence proves that "*the HSPF model based on the "*test case*" parameters produces robust prediction results".*

On the contrary, the narrow band of uncertainty shows that the model is obviously insensitive to parameter changes and, therefore, produces unrealistic results. Two examples show the sensitivity of runoff due to some input variables/parameters:

- Chaves and Nearing (1991) reported an average coefficient of variation for runoff of peak runoff rate of 65%, based on sixty combinations of the 28 WEPP input parameters, with a maximum coefficient of variation of 196%; and
- Guo and Ying (1997) reported an increase in flood peak discharge of 47.4% for the Huayuan basin due to a 1% increase in temperature and a 10% increase in precipitation.

The fact that the HSPF model does not change the output values significantly, when (presumably) a number of sensitive input variables/parameters were varied over a realistic range of values, gives rise to strong concern regarding the accuracy of the simulated results. **Please provide the scientific rationale as to why the model is expected to realistically simulate the change in runoff behaviour because of very severe changes within a watershed, when obviously those changes do not result in changes to the output.**

2) **Issue:** Modelling Philosophy
Reference: All sections related to the setup and effects analysis using the HSPF model
Concern: The proposed project is committed to reconstructing functioning landscapes through the design of new reclaimed watersheds to restore the different functions of nature, such as habitat function (hosting aquatic ecosystems), production function (e.g., biomass), and carrier function (for dissolved and suspended material). The restoration of the aforementioned functions relies first and

foremost on the restoration of functioning hydrologic systems, a central feature of which is sufficient water to sustain re-vegetation efforts (Elshorbagy *et al.* 2005). Such reclamation and restoration efforts are central to making the oil sands mining industry as sustainable a development as possible.

With regard to mining of oil sands in Northern Alberta, Elshorbagy *et al.* (2005) state: "From the hydrologic engineering perspective, assessing the sustainability of a reclamation strategy implies (i) accounting for the different components of the water balance in the reconstructed watershed, (ii) identifying the ability of the watershed to allow for vegetation to be established, (iii) minimizing undesirable deep percolation of water to underlying layers, and (iv) minimizing the detrimental effect of weathering and leaching of saline–sodic water into the surrounding environment." They further state that hydrological modellers using HSPF should "address the issue of the applicability of the models in data-poor conditions, especially when multitudes of field parameters, which are necessary for model calibration, are not measured."

The HSPF model is used to simulate past, present, and future watershed conditions. Future watershed conditions will result in the significant change of some watershed parameters, such as plant interception values, infiltration rates, or soil water variables, such as field capacity, soil depth and redistributions values, as well as groundwater recharge rates and interflow. If the HSPF model is applied under watershed conditions for which it was not calibrated, then the Proponent assumes that all of these parameters are identical in these watersheds.

Beven (2001) states that a parameter set is often only valid for the watershed conditions for which it is defined. The HSPF hydrological model is calibrated only on the basis of runoff obtained at the watershed outlet. This calibration may produce erroneous results:

- when the calibrated model parameters are applied to a watershed with different physical characteristics;
- or for simulations under changed climatic conditions;
- or for simulations for changes in physical characteristics.

The Proponent has used calibrated parameters for conditions that are clearly different from the calibration watershed conditions. **Please provide the scientific basis to transfer hydrological parameters from a calibrated watershed, with certain physical-hydrological characteristics to a watershed that is distinctly different. On what scientific basis do the Proponents assume that reconstructed soils and reclaimed vegetation are identical to baseline watershed conditions? Based on current soil reclamation research undertaken since 1971, what are the typical soil water properties of different terrain units within reclaimed areas? What are the combined effects of a reconstructed landscape under climate change conditions in terms of providing sufficient plant available water?**

3) **Issue:** Kearl Lake Seepage
Reference: Volume 4A, Section 6.4.5.3
Concern: It is stated: "*Basal Aquifer depressurization during mine operation on the JEMA development will not increase the deep percolation water loss from Kearl Lake*." **Please provide the scientific rationale for the statement that the basal aquifer depressurization will not increase the deep percolation water loss from Kearl Lake.**

It is stated: *"After mine closure, runoff from reclaimed areas of Syncrude Aurora South Mine and discharge from Aurora South North Pit Lake will increase the watershed contributing runoff to Kearl Lake to more than three times the pre-development drainage area."* Please provide the impacts of the increased watershed area on the Kearl Lake water balance.

4) **Issue:** Probable Maximum Flood
Reference: Volume 4A, Section 6.4.5.3
Concern: It is stated: "*The pit lake outlet channels have mild side slopes, and will be geotechnically stable. They have been designed to convey floods equal to or greater than the Probable Maximum Flood (PMF)."* **Please provide the scientific method used or the source to define the Probable Maximum Flood (PMF).**

5) **Issue:** Sedimentation of End Pit Lakes
Reference: Volume 4A, Section 6.4.5.3
Concern: It is stated that EPL will trap "*virtually all incoming sediments*". It is further stated that the discharges from the pit lakes "*will carry low suspended sediment loads*". **How long will it take for the pit lakes to be filled with sediments? Please quantify by how much channel erosion in the receiving streams will be increased because of reduced sediment load.**

6) **Issue:** Sediment Yield Estimations
Reference: Volume 4A, Section 6.4.5.3, Table 6.4-16
Concern: Table 6.4-16 lists estimated mean annual sediment yields for various natural and reclaimed surfaces. The values reported are from a study carried out in 1991. Since then, a lot of monitoring has taken place in the oil sands region, and a lot more data are available. This provides an opportunity and obligation to reassess assumptions and parameters based on observations. The principle of adaptive management is widely used, which means that as new information becomes available, existing management strategies are adapted to include the new evidence. There is no information, experience, and new data included in the EIA to either show that the previous assumptions were perfectly correct, or to show how and to what extent previous assumption have to be changed. **Are new sediment data available that were collected since 1991? If new data are available, please report them. If new data are available, please report if any adjustments have to be made to optimize the quality of the predictions.**

7) **Issue:** Mean Seasonal FZlows
Reference: Volume 4A, Section 6.4.7.3
Concern: Mean seasonal flows are used to characterize potential flow and water level changes in the Athabasca River. The 10-year wet and 10-year dry hydrological conditions are reported. The use of both seasonal flows and the 10-year return period are inadequate to characterize the impact of the projects on the Athabasca streamflow. Instead, the flood peak and the 7Q10 low flow, together with at least the 100-year return period, must be applied. **Please provide flow parameters for characterizing changes and effects on the Athabasca streamflow because of the proposed projects for the peak flow and the 7Q10 low flow for at least the 100-year return period.**

8) **Issue:** Incorporation of Athabasca River Flow Trends
Reference: Appendix 3, Section 6.3.4.1
Concern: It is stated: "The results of the analysis suggest a statistical significant negative trend at the 5% level for annual mean flow, and the mean flow in the spring, fall and winter seasons and 7-day low flows for the Athabasca River below Fort McMurray." … "Based on the trend line fitted to the recorded data, … , the forecasted annual mean flow would decrease by about 27% and the 7-day low flow would decrease by 19% by the year 2050 compared to the 1961 to 1990 statistics." **Were these trends integrated into the effects analyses, in particular, into the cumulative effects analysis?**

9) **Issue:** Potential Effects of Climate Change on Low Flows in Athabasca River
Reference: Appendix 3, Section 6.3.5
Concern: The argument is being constructed that instead of using the low flow trends for the Athabasca River at Fort McMurray (1959 to 2006: approximately -0.5 $m^3s^{-1}year^{-1}$, 1980 to 2006: approximately -1.3 $m^3s^{-1}year^{-1}$), one should use the low flow trends at the Bow River near Banff, which has a longer observation period and would, therefore, provide a more meaningful trend. There are issues with this argument that have been mentioned before, for three main reasons:

- One cannot transfer streamflow trends from one geographic area to another, when the two areas lie in different climates. The Bow River at Banff watershed lies exclusively in a subalpine/alpine climate region. The Athabasca River at Fort McMurray watershed lies only to a small extent in the subalpine/alpine climate, to a larger extent in the western Alberta uplands region, and to the most spatial extent in the mixed boreal uplands region. Further, the Athabasca River watershed at Fort McMurray is 60 times larger than the Bow River at Banff watershed, and therefore, has a different streamflow dynamic, particularly with respect to groundwater discharge, which sustains the periods of low flow during the fall and winter.
- Based on the fact that the concentration of greenhouse gases (GHGs) has significantly increased after the 1950s, and the fact that the climate change signals (in terms of both temperatures and streamflow) can generally be detected only since around 1985 (the Proponent states that air

temperature trends are clearly increasing since about 1970), a trend analysis based on a more recent time period would reflect the anticipated changes better than a trend based on a time-series beginning in 1909).

- Higher winter air temperatures in recent decades in the headwaters of the Athabasca River has maintained minimum winter flows near the headwaters from both snow and glacier melt, as it has in the headwaters of the Bow River. However, during the long traverse across northern Alberta, the Athabasca River cannot maintain those maintained minimum flows due to increased evaporation and fewer contributions from tributaries (Schindler and Donahue 2006). Further, it is unclear how long the minimum winter flows can be maintained from increased melt in the headwaters, as the Athabasca glacier has shrunk 25% over the last century (Watson 2004) and is expected to produce reduced melt water flows.

  A trend in low flow where the low flows are getting lower would eventually limit the water withdrawals from the Athabasca River, and also increase the cumulative effects of the oil sands operations, both in terms of streamflow and water quality. **In the interest of preparing for conservative future streamflow conditions in the Athabasca River, please base the hydrological effects analyses of the two projects on appropriate and conservative trend statistics, rather than on statistics from watersheds with very different physical and climatological characteristics. Alternatively, please provide science literature to support your argument that streamflow trends from two completely different watersheds are transferable.**

10) **Issue:** Simulated Climate Change Impacts
Reference: Volume 4A, Section 6.4.7.3, Table 6.4-30
Concern: Table 6.4-30 is a very important table, as it contains results of simulations for the streamflow impacts of the Athabasca River under Application Case with climate change conditions. No detail is provided on how these values were derived. Also, the 10-year return period is inadequate to report streamflow extremes. **Please provide information on the climate change scenarios reported:**

- Which GCM was used?
- Which emission scenario is used?
- How were the streamflow values derived?
- Which variables were changed, and how?
- Was the entire Athabasca River watershed simulated?

As the HSPF model is reportedly insensitive to parameter changes, why is it assumed that climate change scenarios can be simulated?

3.3.2.4 Quantitative Monitoring and Using Targets

It is stated that Shell will modify the existing network of flow and water level monitoring stations to include the expansion areas. **Does the surface water quantity monitoring plan include soil moisture monitoring within the various reclaimed landscapes? Please provide the plans to monitor residual impacts on surface water quantity and soil moisture, including the monitoring design, sample sizes, statistical analyses, models, and assumptions.**

3.3.2.5 Addressing Stakeholder Concerns

No links were established between surface water quantity or soil moisture and TR.

3.3.3 Water Quality

Key Findings: Impact predictions are based on overstatements of some results, vague characterization of confidence in predictions, and unhelpful appeal to conservative assumptions and linkage analyses. References to monitoring are dominated by existing programs, but some parameters measured in 2007 in the Muskeg River Mine exceed guidelines. There are assumptions, but no demonstration that viable biological processes will be established. Given the unconvincing predictions and past monitoring results, the assurance that adverse effects will be alleviated is questionable.

3.3.3.1 Adequacy of Baseline for Benchmarks

Baseline data are not presented explicitly. Instead, the assessment of water quality is based on modelling projections. Model prediction at various time snapshots in the future are compared to appropriate water quality guidelines. Reference is also made to Alberta Environment guidelines for assessment of whole effluent toxicity. Extensive modelling results are presented in Appendix 4-7, in fact, 495 pages of tables and figures are included. Detailed summaries are presented in the form of cumulative distribution curves for predicted occurrence of concentrations of substances of potential concern (SOPC).

Specific Comments and Requests

1) **Issue:** Overstatement of Predictions for Project-related Effects
   Reference: Volume 4A Section 6.1.4
   Concern: It is fair enough that the various summaries (for both base case and application scenarios) use wording to the effect that "*project activities are predicted to have negligible effects on water quality in* …" (page 6-21). These summaries prepare the reader for what will come in more detailed descriptions in later sections. However, care must be taken not to make claims that cannot be substantiated logically (i.e., it is not possible to have complete knowledge of the entire set of

possible outcomes) such as for the JEMA in Section 6.1.4.1 (page 6-3) where it states that "*existing and proposed mitigation measures will ensure that acute and chronic toxicity and tainting potential will be at levels appreciably lower than corresponding threshold levels*." Regardless of the skill in modelling or extent of data collection, there still exists the possibility that adverse effects will be experienced, but careful consideration and thoughtful mitigation aim to reduce this likelihood. Similarly, for the Athabasca River in Section 6.1.4.2 (page 6-22), it is stated that thermal regime, dissolved oxygen concentration, and sediment quality "*will not be affected*"; this may turn out to be the case, but it is not logically tenable to make such an absolute assertion.

2) **Issue:** Overstatement of Predictions – Reclaimed Landscape
Reference: Volume 4A Section 6.2.4 page 6-42
Concern: With respect to Far Future snapshots, it may not be appropriate to state that the reclaimed landscape is at steady-state as this assumes all reclamation will be successful and that equilibrium of some sort is, in fact, the natural state. There exists the possibility that reclamation may fail despite best efforts at modelling, prediction, and mitigation. **Please discuss how the likelihood of success could be evaluated.**

3.3.3.2 Quantitative Data Collection and Analysis

The assessment is not so much about sample sizes and statistical analyses as it should be but about trying to incorporate mechanistic understanding into models used. The goal of the assessment should be about advancing the science of the ecological understanding of the oils sands region. **It would be preferable to see explicit inclusion of mechanistic relations among biological, chemical, and physical components affecting water quality**.

Specific Concern and Requests

1) **Issue:** Modelling Approaches Used for Aquatics Assessment
Reference: Volume 4A, Section 6.5 and Volume 4B, Appendix 4-2, Sections 1.3.2 and 1.3.3
Concern: It is entirely appropriate that both sensitivity and uncertainty are considered in conjunction with the models used, and the explanations for each provided in Sections 1.3.2 and 1.3.3, respectively, are helpful. However, Section 1.3.1 indicates that sensitivity analysis is required in part because of the lack of input data which leads to difficulty in establishing probabilistic models. Clearly, this indicates that more data must be gathered (i.e., basic research into processes that govern the ecology of the oil sands region) in addition to targeted research and monitoring commitments that are made throughout Section 6.5 (e.g., pages 6-407, 6-411, 6-413, 6-417, 6-429, 6-442, 6-447, 6-448, 6-452, 6-459, and 6-469). This issue was also highlighted in the review of hydrology detailed above.

2) **Issue:** Dissolved Oxygen Concentration in the Muskeg River and Polishing Ponds
Reference: Volume 4A, Section 6.5.5, Figure 6.5-4
Concern: There is a large amount of data in this figure for oxygen concentration from 1998 to 2003 and in 2006. It may have been helpful to present a frequency distribution for each month; however, even more striking are dissolved oxygen concentrations in excess of 14 mg/L in pond outflows during winter months. **Even if aeration occurs during outflow, please explain how water coming from under ice, where anoxia likely develops during winter, would be this oxygen rich**.

3) **Issue:** Assessment of Project Effects
Reference: Volume 4A, Sections 6.2.5.6 and 6.2.5.7
Concern: It was confusing at first to read that mitigation was planned before effects were assessed, but then it is stated that these were dealt with iteratively. This is fine, but **please clarify what is meant by "*several layers of conservatism*" (page 6-47) in the preliminary assessments**. Appeal to conservative assumptions is not satisfactory as it presupposes the results of modelling. Certainly experience and intuition play a role in evaluating the suitability of models and understanding the likely effects on conclusions of variation in parameters and sensitivity to them. Complex systems are being modelled, which increases the likelihood of non-linear interactions and unexpected effects. **Please justify how conservative assumptions will be sure to place the results in a biologically meaningful parameter space**. It is possible that failing to parameterize models used accurately or having insufficient data could result in inaccurate conclusions.

It is not clear what the point is of the two paragraphs about Effects Analysis (Section 6.5.2.7 page 6-48). Much of it seems to be a verbal statement of the simplistic ideas in the linkage diagrams used throughout. In the introduction to the EIA Section 1.3.5 states that a linkage analysis consists of identification of project activities that could contribute to environmental change, analysis of potential linkages, analysis and classification of impacts, and identification and description of mitigation measures and monitoring of potential residual impacts. Similarly, Section 6.2.5.6 states that linkage analysis is a tool to identify activities that may affect aquatic resources, identify pathways along which these potential effects may occur, identify receptors or endpoints, and evaluate the validity of linkages between project activities and endpoints based on configuration and mitigation measures included. Linkage analyses may be useful to organize possible routes by which water quality and other aquatic resources might be affected, provided they do consider explicitly and mechanistically the connections among these components. It is stated that analysis may result in the linkage being declared 'invalid'. However, a distinction must be made between not considering a possible mechanism because it is not logically feasible versus dismissal based on another prediction in the EIA that itself should be scrutinized. The latter may not be good science. For example, Section 6.6.4.3 considers potential effects of acidifying emissions on aquatic health in the local waterbodies, local small streams, and the Muskeg River (page 6-494). Where predicted acid input rates did not exceed

critical loads, linkages were deemed invalid, as they were when exceedance of the critical load was less than 4% (for a lake already at its critical load). **How can it be stated that any further increase does not matter?** It is inappropriate to assume infallibility of one component of the EIA so as to dismiss possible effects in another. **Can assurance be provided that where linkages have been deemed invalid, the possibility for discovery of unexpected results that may result from non-linearities, for example, has not been precluded?**

It would be helpful to see in the main discussion of water quality modelling, particularly for pit lakes, dynamic descriptions for interactions among biological, chemical, and physical components (e.g., equations describing mechanistically processes other than simple decay) as these would allow for critical examination. Consider Figure 6.6-1 where linkages for aquatic health are illustrated (page 6-476). Every arrow connecting triangle, rectangles, and diamonds can be described mechanistically and should consider dynamics relationships among biological, chemical, and physical elements involved.

4) **Issue:** Unclear Statements, Lack of Mechanistic Consideration, Characterization of Data Quality – JEMA
Reference: Volume 4A, Section 6.5.5.3
Concern: Mitigation Section – It is stated (page 6-397) that "*a self-sustaining closure landscape and drainage system will be constructed to have similar characteristics as natural systems in terms of dynamic stability, robustness, longevity and self-sustaining capability*". As before, such a landscape is the target, but it cannot be stated that it will be successful, as reclamation here is a large experiment. More appropriate is the wording in the concluding sentence of the paragraph where it states that "*the closure landscape will be designed to encourage effective drainage …*"

Effects Analysis Section – Increases of 10% above pre-development or Base Case are deemed to be negligible (page 6-399) because it is stated by the BC Ministry of Environment, in a document discussing setting of water quality criteria, that low-concentration metals are often measured with less than 20% precision, and that natural variability often exceeds this figure as well. It is fair to recognize that some substances will have high concentrations naturally, but this seems a weak standard to deem certain results negligible. Natural variability (spatial and temporal) may indicate that the particular substance interacts with other dynamic processes, and this should be addressed either with more data to characterize the patterns accurately or by better mechanistic understanding of processes responsible for concentrations observed. **Alternatively, if it becomes too onerous to conduct the basic research to understand specific processes in detail, would the Proponent consider an approach by Reckhow (1999) whereby probability network models are used to provide predictive capacity?** However, Reckhow (1999) also recognizes that "observational data for parameterization of water quality models are almost always woefully inadequate for the task."

Prediction Confidence Section- Data used to characterize water quality were judged to be "*of moderately high quality*" (pages 6-406 and 4-428) because they could be fitted to parametric distributions and there were few outliers. It is meaningless to characterize data in this way; analyses that summarize water quality and facilitate detection of effects will determine the usefulness of the data. A statement such as this indicates a lack of consideration of how process errors (structural uncertainty in models) and observation errors (data uncertainty) enter into the quantitative considerations. Not dealing with these distinct sources of error may affect estimates of uncertainty which is a core component of the evaluation of fates of possibly toxic substances in water. **Are there alternative analytic structures or models that can incorporate so-called outliers, particularly those attributable to process error?**

Prediction confidence as "*high*" (pages 6-407, 6-411, 6-448, 6-541), "*fairly high*" (page 6-413), "*moderately high*" (page 6-459), of a "*reasonable level*" (pages 6-417 and 6-452), or that conservative assumptions aim to capture scenarios with a "*high degree of confidence"* (page 6-429) are not informative. Similar issues arise with respect to consideration of water quality in pit lakes where information for receiving stream water quality is apparently of "*moderately high quality*" (page 6-428). Similarly, with respect to potential effects on the thermal regime because of the PRMA the "*high level of confidence*" is based on the "*quality of the observed data*" among other influences (page 6-446). Characterizations of data as being of a particular quality are meaningless because analyses that summarize water quality and facilitate detection of effects will determine the usefulness of the data.

Similarly, in Section 6.6.4.4 (page 6-513) with respect to residual effects in the Muskeg River, Jackpine Creek, and Kearl Lake, the magnitude of potential effects (predicted to be negligible) based on conservative assumptions, predicted levels of whole effluent chronic and acute toxicity, predicted concentrations in water and fish tissue, and sediment quality are conflated with high confidence in the predictions. Magnitude of potential effects and confidence in the predictions are two separate issues. The same applies to comments in Section 6.6.5.5 (page 6-535) where the PRMA is discussed, and to Section 6.6.6.5 (page 6-546) where the Athabasca River is discussed.

5) **Issue:** Confidence in Predictions, and Lack of Evidence in Predictions for Water Quality in Pit Lakes
Reference: Volume 4A, Section 6.5.5.3
Concern: Pit lakes may represent one of the largest potential liabilities on the closure landscape. Therefore, it is appropriate that reference is made to ongoing research and positive results to date for wetlands and test pits. However, that which is cited hardly represents an overwhelming amount of current literature: the most recent citation is for a thesis from 2003. Even a cursory search through the literature associated with pit lakes, toxicity of process-affected waters, toxicological effects on aquatic organisms, *etc.* indicates that much more current research is available and this needs to be synthesized and interpreted here with respect to the project. The lack of support for the assertion that "*Over time, these lakes will progress into biologically productive systems*" (page 6-426) is

an appreciable deficiency. It should be noted that later in the assessment (Section 6.6.4.4 page 6-521) reference is made to more current findings by Leung *et al.* (2003) and Siwik *et al*. (2000). The retention of international modelling experts to review work by CEMA's End Pit Lake Sub-group is appropriate. **Please provide more recent scientific research literature into the discussion. This same issue is raised in the hydrology section of the review report.**

Water quality projections for pit lakes in the JEMA are presented starting with a discussion of the use of linkage analyses. Linkage analysis was commented on earlier, but the linkages discussed on page 6-418 through 6-420 describe little more than flow of water through various pit lakes (South, South Central, North, and North Central) on the closure landscape. Linkages that should be considered and characterized quantitatively are interactions among biological, chemical, and physical features of the aquatic habitat. Water in pit lakes will receive treatment by dilution, biodegradation, and further settling (page 6-420, page 6-454) which will be enhanced; it is asserted, by littoral zones that will promote biological activity. Water quality projections are based on decay of concentrations of toxicants in pit lakes and conclusions that various additions to surrounding waters will be negligible depend on concentrations of substances declining to below aquatic guidelines before release. Table 42 on page 123 of Volume 4B Appendix 4-2 provides decay rates used in modelling. Some possibly toxic substances will decay naturally through biological process such as is the case for naphthenic acids (Headley *et al.* 2002). However, not all toxicants may decay unassisted. **What assurance is there that viable biological processes will be established, and should these fail, what contingency measures could be implemented given that drainage areas will continue to drain and supply water to pit lakes and to natural waterbodies, all of which discharge ultimately to the Athabasca River?** It is stated that if suitable water quality is not achieved by the time of initial discharge, then rate of filling will be reduced and appropriate treatment provided before discharge (page6-429); however, water will continue to be supplied from the closure landscape and will have to be dealt with. **If an appropriate treatment can be provided when water quality is sub-standard, then why not apply it to all water and be assured of adequate quality?**

It is admitted that 'toxicity predictions do not address bioconcentration, eutrophication, genotoxicity or endocrine disruption effects' (LaPoint and Waller 2000 cited on page 6-484). If these effects are to manifest anywhere, then perhaps it will be in the pit lakes where water has a longer residence time. **Can assurance be given that the complex interactions among biota and their environment characteristic of lakes will establish successfully?**

6) **Issue:** Relevance of Results for Whole Effluent Toxicity
Reference: Volume 4A, Sections 6.5.2.7 and 6.6.2.12 and results in Sections 6.6.4.3 and 6.6.5.4, Volume 4B, Section 2.1.2.2

Concern: Water quality parameters examined are outlined (Tables 6.5-1 and 6.5-2) and the list appears to be appropriate. Examination of whole effluent toxicity (WET) is included as a means for evaluating potential effects of synergistic and additive toxic effects of complex mixtures (page 6-360) because it is "*the most relevant indicators of potential effects to aquatic organisms*" (page 6-483). Both acute and chronic WET are considered because they describe the potential for water as a whole to affect aquatic organisms. This accounts for potential synergistic or additive toxic effects of complex mixtures (i.e., presence of multiple SOPCs). Alberta Environmental Protection (AEP 1995) guidelines for WET determination also indicate that interactions among different substances are not adequately understood. It is hard to test potential toxic effects of a complex mixture that does not yet exist (for PRMA, but JEMA may have samples from adjacent existing development, and it is stated in Section 6.5.2.10 that similar waters are used from existing operations). The point is to be open to detecting new effects caused by unanticipated effects or poorly understood synergies. **How can this happen if potentially novel properties exist for the developments being evaluated here?**

Whereas it is possible during modelling of individual substances to sample repeatedly from the respective distributions established, can this be done meaningfully for toxicity? In Appendix 4-2 (page 57), it is stated that extrapolation from toxicity tests to natural populations and communities is valid because such tests are usually predictive of effects on natural aquatic communities (Environment Canada 1996 is cited, but note that Environment Canada 1999 may be more current). There needs to be better explanation of how complex interactions among components of aquatic ecosystems are accounted for fully in this scaling-up exercise. **Could more detail be provided as to how modelling occurs for WET?**

WET may be useful where effects are of constituent toxicants are well understood. It is preferable that there be mechanistic understanding of individual toxicants. Acute and chronic toxicity of whole effluent are projected based on existing sources assuming that the effluent will be similar when the project is yet to be built (i.e., there is yet no contaminated or process-affected water to be used in assessing toxicity). Similarly, will there be the same effects of decay, dilution, or other interactions on all constituent potential toxicants. This seems unlikely and omits questions of synergistic or antagonistic effects or any other type of complex, dynamic interaction. **Because WET synthesizes many possible effects and mechanisms, can more detail be provided as to how the dynamic and probabilistic modeling accounted for complex interactions?**

Fleeger *et al.* (2003) conclude in their review of ecotoxicology that pollutants and toxicants exert effects through indirect ecological mechanisms. Typical single-species, laboratory-based toxicity tests do not consider population, community, and ecosystem-level effects. Relyea and Hoverman (2006) also stress the importance of indirect effects (mediated both through changes in density of affected species and through changes in species' traits) in understanding broader effects of toxicants.

3.3.3.3 Quantitative Monitoring and Using Targets

A useful starting point for monitoring has been presented; however, assurance must be provided that potential adverse effects will be detected soon enough to allow quick action.

1) **Issue:** Suitability of Monitoring Proposed to Detect Potential Effects
   Reference: Appendix 4-9, Section 4
   Concern: Monitoring of water quality is mentioned in various places, but is dealt with most explicitly in Appendix 4-9. The plan proposed takes advantage of current monitoring particularly by the Regional Aquatics Monitoring Program (RAMP) with several extra sites added (Table 5). Sampling points illustrated in Figure 8 (page 35) seem appropriate, and using the same statistical analyses as those used by RAMP (Section 4.2.1.6) is a suitable starting point; building from past analyses should allow for ready comparison when JEMA comes online. Sampling locations for the PRMA are described verbally (Table 6 and page 40), but sampling must be sufficient to detect change as there is not the established baseline as for JEMA. As it is presented the monitoring plan seems a good start. **Will the Proponent consider the addition of technologies such as semi-permeable membrane devices instream to provide longer-term integrated measures of water quality? Please provide assurance regarding what will happen should water quality deteriorate.** Monitoring must provide early detection of adverse changes so as to allow timely remediation.

3.3.3.4 Addressing Stakeholder Concerns

If waterbodies or watercourses in the LSA or RSA are changed by the Project, the Mikisew Cree may be affected if fish, the traditional resource most likely to be affected, were no longer available or were tainted.

TEK is mentioned in Section 6.5.4 (page 6-374) but cites mainly current concerns no different than those of any other stakeholder. TEK is considered again in Section 6.6.3 (page 6-491) but the chief concerns relate to fish and their habitat and therefore, are dealt with elsewhere. TR are not discussed with respect to aquatic resources.

3.3.4 Fisheries

Key Findings: Currently methods proposed and applied are insufficient to demonstrate success in meeting the mandate to restore aquatic resources as required by the *Fisheries Act*. The compensation lake proposed under the No Net Loss program, will replace existing lotic habitat with an artificial lentic

habitat. The Mikisew Cree concern about the cumulative effects of water withdrawal on fish, combined with declining flow anticipated cumulatively in the river has not been addressed.

3.3.4.1 Adequacy of Baseline for Benchmarks

The EIAs have indicated the possible effects of the developments, and have identified those components of the Project that are expected to affect fish communities, their habitat, and health and how those effects will be mitigated or compensated for. The ESR provides a field-oriented database on which much of the EIA for fish and fish habitat is based. The Environmental Setting in the EIA (Volume 4A, Section 6.7.3) is in large part a précis of that report. Overall the approach to assessing baseline data on fish populations and fish habitat in the ESR is thorough and meets regulatory standards. The literature review covered the pertinent publication sources for the information required. An appreciable number of samples were used throughout the LSAs that were considered representative of all watercourses and waterbodies. Sites in LSAs were investigated during all four seasons; however, not all sites were monitored every season and not all sampling was conducted every season, although sampling for major metrics (water quality, fish sampling) were carried out in at least two or three seasons. The standard of work is consistent with that which has been presented to date for baseline fish population and aquatic habitat inventories in the oil sands.

The Proponent also presents results for some fish species that could be TR. Arctic grayling provide a regionally important sport fishery in the northeast Boreal region. They are a species of management concern in Alberta and are listed "sensitive" by the Province. Their numbers have declined across northeastern Alberta given development and habitat disruption and increased access to watercourses by anglers where originally there was little, if any (Walker 2005). With respect to the JEMA Project, the ESR indicates that numbers of Arctic grayling as well as other species from 1981 to 2004 migrating into Jackpine Creek have declined (ESR Table 5.4-5). **Is this an atypical 1 year event, or does this represent a gradual deterioration in conditions in the region over time?**

Similar to the documented decline in Arctic grayling in Jackpine Creek, the drop in migrants in the Muskeg River is particularly evident in ESR Table 5.4-2, where total number of migrant species has declined overall by nearly 90% in the past 30 years, but has actually increased many-fold since 1998. Although one possible explanation given is the increase in beaver activity in the region causing stream blockages with dams. **Please explore other possible explanations because these changes may signal a gradual deterioration of fish abundance and aquatic habitat in the region overall.**

3.3.4.2 Quantitative Data Collection and Analysis

In the ESR (ESR, Section 5.2.2), which provides field-based baseline data, habitat evaluations were conducted according to standards accepted by Alberta Sustainable Resource Development (ARSD) and methods are appropriate.

Specific Comments and Requests

1) **Issue:** Lack Details of Fish Capture Methods
   Reference: ESR Table 5.2-6
   Concern: Gill net details are provided in ESR Table 5.2-6; however, electrofishing details useful for future study replication are lacking (e.g., current used, electrofisher settings). **Please provide this information**. Electrofishing effort per site for most sites (>500 s, but some sites <300 s) should be adequate to discern fishes present.

2) **Issue:** Inconsistent Setting of Minnow Traps
   Reference: Fisheries
   Concern: Minnow traps are an excellent passive capture technique that provides researchers with a way to capture small-bodied fishes that are less prone to being caught electrofishing. For the most part, minnow traps sets were short (<2 h), which may not be sufficiently long to trap representative numbers of fishes if their abundance is low. It appears that minnow traps were set for much longer periods at some times, notably fall, indicating overnight sets. This discrepancy makes it difficult to compare results across and within sites or as a benchmark from which change can be quantified. **Please discuss this discrepancy and provide a justification for the conclusions predicated on this data.**

3) **Issue:** Inconsistent Terminology
   Reference: ESR Section 5.2.3
   Concern: The Species Richness Index formula presented is a relative one, albeit useful, as it compares the number of species found at a site relative to the number found within the study area. Thus, it rightfully should be referred to as a relative species richness index, rather than simply species richness, as the latter usually refers to simply number of species or taxa present per site, as it is used for the benthic invertebrate data. **In short, terminology and approaches should be consistent between indices used for fish and fish habitat and those used for benthic invertebrates to avoid unnecessary confusion.**

4) **Issue:** Ranking and Interpreting Data
Reference: ESR Tables 5.2.8 and 5.2-9
Concern: The Proponent provides ranks from individual indicator ranking groups by multiplying them together to provide a general ranking of species diversity. However, the ranks will not be evenly distributed on a linear continuum from 0 to 64, making interpreting the data more difficult. The ranking of scores in ESR Table 5.2-9, for example, would imply there is no qualitative difference (i.e., both high) in a general rank score of 30 versus 60.

5) **Issue:** Missing Formulas
Reference: ESR Section 5.2.4
Concern: In the data analysis, **the formulae for determining Simpson's Diversity Index and the evenness index should be provided.** It would also have been useful to calculate Shannon-Weiner (*H*') indices as well, as this index generally has more widespread use in the literature, and thus provides another platform for future comparisons. The value of SDI is that it is relative (i.e., from 0 to 1) rather than absolute, so it is worth mentioning that point in giving the rationale for exclusive use of SDI over multiple indices.

6) **Issue:** Lack of Rationale for Parameters Used
Reference: Fisheries
Concern: Please provide the rationale for sample size, frequency, and number of samples chosen because it is not clearly defined consistently. This affects TR in the sense that the definition of a reclaimed aquatic resource on the lease at closure could be argued based on chance alone, rather than sample artefact. Success or lack thereof must be dictated by the results from replicated sampling before (the baseline) and at and beyond closure with statistically rigorous comparison. This means that samples collected are replicated, a sufficiently large number of times, across seasons and consistently. Depth of sets, electrofisher settings, output, and effort are not reported consistently. **Without this information, how can stakeholders be assured that the Proponent has (or has not) complied with their mandate to restore aquatic resources as required by the *Fisheries Act* Authorization to be released for the Projects.**

3.3.4.3 Quantitative Monitoring and Using Targets

Developing a summary ranking of fish and fish habitat diversity, such as that described in the Environmental settings Report (Sections 5.4.2 and 5.5.2), to give an overall diversity is an interesting approach that may be useful for comparing waters in the study area. However, it should be considered only as a qualitative assessment for that purpose. It may be overly simplistic to weigh fish species diversity, habitat diversity, and ecosystem diversity equally for an overall rank and put much value to it in any quantitative sense.

Specific Issues and Concerns

1) **Issue:** Lack of Regional Monitoring
Reference: Fisheries
Concern: Regional monitoring (within the RSA) is tied to RAMP and rests there. Each proponent in the oil sands, including Shell, is obligated to monitor surface and sub-surface water quality through the life of their operation and during reclamation and site closure as per regulatory requirements. **Please provide regional monitoring plans.**

2) **Issue:** Uncertainty of Effectiveness of Mitigation Measures
Reference: Fisheries
Concern: Linkages were identified for the JEMA project's development between fish habitat, stream flow and water levels, channel regime (Muskeg River only), water quality, sediments, benthic invertebrates, and habitat accessibility. However, the report states that effects of most of these components will be negligible, otherwise mitigated, or fully compensated for. The linkage analysis also indicates that there will be negligible effects of the JEMA Project on surface water quality, thus no effects on fish health or fish abundance are expected (i.e., thus, linkage path considered invalid). This assumes that mitigation measures, such as development of a self-sustaining closure drainage system, will work.

   Valid linkages were identified for PRMA project's development between fish habitat and habitat area, water quality, benthic invertebrates, and habitat accessibility. Mitigation measures are similar to those proposed for JEMA. As for JEMA management of surface water drainage, a closed-circuit system will be put in place to eliminate water release from the mine area into surrounding watercourses. Again, this assumes that the system will be 100% effective and cover all future contingencies.

   If the mitigation measures fail for some unforeseen reason, this could leave waterbodies and watercourses vulnerable to project waste input, which could affect aquatic health. **How can the Proponent purport that the Project will have negligible effects on surface water quality, and thus fish health/abundance, given the uncertainty in the effectiveness of the mitigation measures?**

3) **Issue:** Uncertainty in Project Effects
Reference: Prediction Confidence, pg. 6-631
Concern: The Muskeg River flow analysis suggests there will be a negative effect on habitat from reduced peak flows for some duration but that this effect will be of low magnitude. With compensation, the overall effect on fish habitat is predicted to be negligible. Similarly, it is also predicted that, after compensation, effects of changes in Muskeg River channel morphology will be negligible. Again, this assumes that compensation measures will be appropriate and fully effective. **Are there examples of where these compensation measures have been effective? Given**

that the Proponent recognizes the uncertainties in their own prediction confidence, how will the Proponent ensure that the Mikisew Cree can continue to pursue traditional rights?

4) **Issue:** Effects to Northern Pike Migrations
Reference: Fisheries
Concern: The report suggests that a more stable flow regime in the Muskeg River may benefit northern pike in terms of embryo survival, but also suggests a possible reduction in available habitat. The reduced spring flow may also affect spring migrations as northern pike spawning movements are cued to both temperature and flow, with optimal conditions for each occurring in close temporal proximity. **Please discuss whether this may change conclusions for northern pike.**

5) **Issue:** Low Fish Species Presence
Reference: ESR Section 5.4.1.2
Concern: Despite the extensive documentation of fish species' presence in the Muskeg River system, field survey fish catches, as described in the Environmental Settings Report, appear to be low, particularly of sport and sucker species. **Please justify how the fish abundance at these low levels would be adequate for comparisons with future monitoring programs?**

6) **Issue:** Decline of Migratory Fish
Reference: ESR Section 5.5.1.2
Concern: Similar to that in the Muskeg River and Jackpine Creek, the counting fence data for the Pierre River in 2006 provided in the Environmental Settings Report suggest there has been a significant decline in migratory fishes into these Athabasca River tributaries. This decline may be significant in the context of existing regional operations over the last few decades. **How will this impact the Mikisew Cree's Treaty Rights to harvest fish?**

7) **Issue:** Lake Compensation Resulting in Different Aquatic Communities
Reference: Volume 4B, Section 4.6
Concern: A significant amount of aquatic habitat (nearly 0.8 million m^2, or 0.8 surface ha) will be lost during operations in JEMA, with an additional amount (1.65 million m^2) to be lost at closure (Table 6.7-11). To offset the loss in the Conceptual Compensation Plan, in accordance with the No Net Loss program, a compensation lake is planned. However, no description is provided on how big the lake will be or what fish and aquatic communities are planned for the lake. While a lake may provide some benefit in relative productive capacity, compensating natural historic lotic habitat with artificial lentic habitat, which will probably develop a different aquatic community from the one lost, does not seem to be an even trade. **Please provide justification for the removal of lotic habitat with the replacement of lentic habitat.**

8) **Issue:** Loss of Creeks
Reference: Table 6.7-19
Concern: The lower portions of a number of creeks in the PRMA will be lost (nearly 1.9 million m^2, or 1.9 surface ha during operations in PRMA with additional 0.45 million m^2 at closure). The losses are to be compensated by the creation of new habitat. Again, it assumes that mitigation measures, such as temporary and post-closure structures to provide fish passage access from the Athabasca River into the Pierre River will be fully effective and functional for the species of concern. **How can the Proponent ensure that these mitigation measures will be effective?**

9) **Issue:** Compensation Lakes
Reference: Fisheries
Concern: A compensation lake is planned to compensate for loss of fish production under the principle of No Net Loss. Its morphology and aquatic faunal assemblage are being finalized in 2009 under a separate mandate. While this may be production-capacity neutral, or actually increase capacity, again it is not the most desirable approach for compensation if it trades off lotic habitat and its associated biotic community for lentic habitat. Thus a deep, artificial lake should be considered as the least desirable option unless the compensation is for replacement of like habitat such as the unnamed waterbodies that will be lost.

A number of deep (>5 m) compensation lakes have been proposed to compensate for fish habitat losses under the *Fisheries Act* by proponents in the Oil Sands region. The deep compensation lake option has been driven largely by Fisheries and Oceans Canada (DFO) as appropriate compensation. All compensation lakes proposed to date have predicted resident functional boreal aquatic ecosystems as their outcome over time; however, all share a similar lack of certainty of outcome even if proponents will be forced to guarantee the lakes success by DFO through legislated requirements.

To mitigate uncertainty associated with the compensation lakes to date, we recommend that a shallow lake free of mixed fine tailings (MFT) be constructed to replicate those standing water bodies that have been lost in the RSA (and will be lost within the LSA). Shallow lakes (like Kearl or shallower) have a certainty of successful outcome since these are what occur naturally on the upland areas next to the Athabasca River within the region. Furthermore, the need for variation in compensation approach would ensure some measure of success based on chance alone.

Much of the closure landscape will contain shallow EPL and polishing ponds. Their purpose will be to hold back or clean toxins before these are allowed to enter "receiving" waterbodies.

Riparian buffers around shallow waterbodies support the greatest biodiversity and provide movement corridors for animals (including people). **Will EPL and polishing ponds support riparian buffers with native biotic indices typical of those found on upland ponds and lakes (e.g., Kearl Lake)? What will Shell do to encourage riparian buffers to grow around these ponds (and the compensation lake)?**

10) **Issue:** Cumulative Effect of Water Withdrawal
Reference: Volume 4A, Sections 1.1.1 and 6.7.7.1 and Volume 3, Section 2.5.3.2
Concern: As recognized by this EIA, an increase in the volume of water to be withdrawn from the Athabasca River will be required (at the intake) and the potential exists for this and surrounding developments to affect the Athabasca River. This is a *principal concern* as the cumulative effect of water withdrawal by developments alters the volume and flow regime of the river. The Project will be expected to adhere to the requirements of the AENV/DFO's (2007) *Water Management Framework* for the Athabasca River. The project has been predicted to reduce annual flows in the Muskeg River by 8.3% from JEMA operations by 2052, and weekly flows in the Athabasca River by 0.3% in summer and 1.8% in winter from PRMA operations (Volume 3, Section 2.5.3.2).

Mitigation measures will be included managing water withdrawals to meet Alberta Environment (AENV) and DFO criteria to reduce effects on aquatic resources in the Athabasca River. While water withdrawal of this project is designed to fall within AENV/DFO guidelines for water removal, the cumulative effect of such removals by all existing and approved could have adverse, serious effects on water resources of the river during key times of year when flow is low and peripheral habitats stressed. Water use predicted by oil sands proponents is already in question, despite predictions otherwise, by stakeholders in the region. Thus, any water withdrawal must be viewed with caution and, if allowed, carefully monitored to ensure compliance. AENV has yet to release their minimum flow requirements for key times of year in the lower Athabasca River. **Why have these requirements not been released?**

11) **Issue:** Incorrect Figure
Reference: Volume 4A, Figure 6.4-1
Concern: Figure 6.4-1 illustrates dissolved oxygen measurements recorded from the outlets of EPL, ponds, and other water bodies. Dissolved oxygen concentrations in excess of 15 mg/L are plotted in this figure during winter and into spring months. This seems extraordinary since water is never supersaturated during winter in boreal ponds with, or without oil sand development. **Please clarify whether the X's are plotted incorrectly since the "actual" high dissolved oxygen concentration (solid circles) seem reasonable on the Figure.**

3.3.4.4 Addressing Stakeholder Concerns

No direct links between fish habitat/abundance and TR use were addressed. The TR used typically (besides water) is linked more closely with riparian zones rather than the watercourses *per se*. Riparian zones are the movement corridors for wildlife and furbearers.

3.3.5 Aquatic Health

Key Findings: Both projects have the potential for significant effects on aquatic resources in the region because of their proximity to major watercourse systems. The level of sampling for the baseline data to establish benchmark data on fish tissue quality was inadequate. The EIA does not consider other non-lethal end-points that may have profound effects on fish communities. The monitoring program does not include a component to monitor fish health. The reliance on regional monitoring plans (e.g., RAMP) to address cumulative effects is insufficient to protect Treaty Rights.

3.3.5.1 Adequacy of Baseline for Benchmarks

Both the PRMA and JEMA projects have the potential for significant impacts on aquatic resources in the region because of their proximity to major watercourse systems: the Muskeg and Athabasca rivers. A potentially major threat to fishes and their health, particularly in waters that receive drainage from both projects, is the input of noxious substances (e.g., heavy metals, hydrocarbons) via runoff. This threat is significant because of the number of tributaries that flow through the project-affected areas and drain directly into the Pierre, Muskeg, and Athabasca rivers, and also the fact that the Muskeg River flows through the JEMA Project.

The EIA report has described well the base case and application for issues relating to aquatic health, i.e., particularly fish health, and established the linkages between air, water and sediment quality, and possible changes in aquatic organism health. Aspects of aquatic health have been assessed in the context of the ToR established by AENV and DFO. Under Aquatic Resources, these ToR indicate the following topics, among others, to be addressed: (1) the potential for tainting of flesh, survival of eggs and fry, chronic or acute health effects, …; and (2) the potential for increased stress on fish populations from release of contaminants, sedimentation, flow alterations, …(Volume 3, Appendix 3-1).

Specific Comments and Requests

1) **Issue:** Inadequate Sampling
Reference: ESR for Aquatic Health; Section 4.1 (Introduction), Section 4.2.1 (Sample Collection), Section 4.3 (Results)
Concern: The stated main objective was to establish benchmark data on fish tissue quality (i.e., heavy metal and organics concentrations). However, sample sizes for fish tissue analyzed to provide these data from species as indicated in Section 4.2.1, Table 4.2.1 are n = 1. This level of sampling is inadequate to provide sufficient baseline data to make a firm conclusion of existing state of fish health or for future comparisons. A sample size of one provides no statistical power or no indication of population variation of the indicators tested for. For samples made as composites from small-bodied fishes, combining species is probably not appropriate because of physiological differences in metabolism and clearance.

No indication is provided in Sec. 4.2.1 (Sample Collection) of how fish were processed in the field, which tissues were used (muscle?), how fish tissues were handled to avoid cross-contamination, and how samples were stored before delivery (flash-frozen?) to ensure sample integrity and quality control. While the list of variables tested for was comprehensive and appropriate (Sec. 4.3. Results: 4.3.1 Metals and 4.3.2 Organic Compounds), and levels were low and below relevant criteria (except for aluminum in lake chub at PRMA site, which was more than twice the threshold level), again, small sample sizes compromise the usefulness of the measurements as baseline data for future comparison.

We recommend requesting an increase in sample size, which would strengthen the rigour of analyses performed on individual parameters. Tissue sampling and analysis are expensive to do; however, compromising sample size can put ecosystem health at risk for aquatic life and humans. At least 30 samples need to be collected of individual parameters to achieve statistical significance.

3.3.5.2 Quantitative Data Collection and Analysis

The assessment approach is based on the notion that "*whole effluent acute and chronic toxicity are the most relevant indicators of potential effects of oil sands release waters to aquatic organisms* (Volume 4A, Section 6.6.2.12). However, the end-point indicator of toxicity used is lethality and the EIA does not consider other non-lethal end-points that, in the long-term, may have profound effects on fish communities, notably for the contaminants of concern, geno-toxicity and endocrine disruption effects. For example, the small, but cumulative disabling physiological effects experienced by embryos of fishes when exposed to tar sands sediments (D. Schindler, U of A, Biological Sciences, pers. comm.). **Why**

does the Proponent not consider these other non-lethal end-points that may also have profound effects on fish health?

Specific Comments and Requests

1) **Issue:** Weak Support for Conclusions
   Reference: Section 6.6.2.12
   Concern: The Assessment Approach does acknowledge that endocrine disrupters and geno-toxicants may be present in Project effluent waters but that potential effects are deemed not to be expected. This conclusion is based on a lack of observed effects on fecundity to date, for the case of endocrine disrupters, and the observation that potential geno-toxic effects do not appear to be at levels that would affect populations. This premise lacks rigour, particularly given the few citations provided to support that conclusion. For example, for endocrine-disrupting compounds, which include complex hydrocarbons, sub-lethal effects are not limited to fecundity, but can include effects on male gametes or on reproductive behaviour. Similarly, sub-lethal geno-toxic effects may not be manifested in immediate generations. **At this point, limited scientific understanding of the indirect sub-lethal effects of these compounds, singly or in combination, may preclude the ability to assume that no effects of their presence in effluent waters on fishes would be expected. Please discuss.**

2) **Issue:** RAMP Monitoring
   Reference: Aquatic Health
   Concern: The JEMA and PRMA require additional water be withdrawn under licence from AENV given operational requirements predicted in the operating plans in the EIA for both. **What assurance can the Mikisew Cree receive that RAMP testing will be sufficiently rigorous to monitor fish population health and abundance over time?**

3.3.5.3 Quantitative Monitoring and Using Targets

Key to the success of all mitigation and compensation programs is a well-designed continuous monitoring program that adopts an adaptive-management approach, which is described in Vol. 4B, Appendix 4-9. While a program has been designed to monitor changes in fish abundance, diversity, and habitat, the monitoring program does not include a component to monitor fish health but rather relies on RAMP for routine monitoring of fish tissues. However, as indicated in Volume 4B, Section 5.1, fish tissue tainting studies were last conducted in 2001. RAMP studies may not be sufficiently frequent or detailed enough to detect health changes in fishes that might be caused directly from the activities of this Project. **How will the Proponent assure the Mikisew Cree that fish population health is being monitored adequately through RAMP?**

Specific Comments and Requests

1) **Issue:** Linkage Analysis
Reference: Aquatic Health
Concern: For JEMA, linkages between direct and indirect effects on aquatic health from changes in water quality, changes in sediment quality, and uptake of substances into fish tissues were determined to be valid. However for the most part, effects of SOPC are expected to be low or negligible, or have no effect. Some heavy metals are predicted to increase from changes in flows through pit lakes. Such metals may be of concern if they are allowed to increase and persist in the natural environment (e.g., chromium, cadmium). **Would the Proponent consider monitoring more rigorously for these metals?**

For PRMA, only linkages between direct and indirect effects on aquatic health from changes in water quality and uptake of substances into fish tissues were considered valid. As clearly stated in the report, potential effects of the Project on aquatic health are related to water quality directly in receiving waters that could be affected by the release of process-related effluent, for which steps have been described to minimize those effects. As a result, effects on aquatic health and fish tissue quality in PRMA from contaminants, such as heavy metals and PAHs, are predicted to be negligible. Again, this assumes that all measures taken to contain effluent waters and protect receiving water from such discharge will be fully successful.

2) **Issue:** Cumulative Effects of Toxins
Reference: Aquatic Health
Concern: Perhaps the greatest potential impact of the Project on regional aquatic health is on that of the Athabasca River, its fish community, and those that depend on the river's resources for livelihood. The report indicates that since predicted levels of SOPCs will be below no-effects thresholds and, thus, in compliance with established guidelines, aquatic health in the Athabasca River will be protected; i.e., any effects of SOPCs will be negligible. A similar conclusion was reached for the Planned Development Case (Section 6.6.7.1, Key Question PAR-4) as predicted conditions are the same as for the Athabasca River application case.

To date, all oil sands proponents have described adverse effects to be negligible in the Athabasca River downstream from their operations. **At what point do small (i.e., negligible) effects on tainting and tissue metal burden following exposure to run off, which ultimately ends in the Athabasca River, become cumulatively detrimental to aquatic health?** The proponent argues their runoff will provide a clean bill of health and not lead to bioaccumulation of metals and tainting in the lower river (i.e., Peace-Athabasca Delta); however this is where sediment is appreciably finer and more likely to bind toxins and hydrocarbons in negligible concentrations. **Did the Proponent consider this in their analysis?** In general, small incremental (negligible) changes in any parameter, when combined, can result ultimately in additive cumulative effects that may be

positive or negative over time. The modelled data does not give peace of mind, especially among locals who perceive this as a disjoint with reality.

3.3.5.4 Addressing Stakeholder Concerns

The link is established between the traditional use of fishes historically from the Athabasca River and McLelland Lake and ongoing from several tributaries by FNs for subsistence (including the Firebag and Muskeg River).

The EIA reports and interprets data to conform to AENV/DFO guidelines required and requested by the ToR for both the Shell Jackpine Expansion and Pierre River mines proposed. **However, we recommend that the Mikisew Cree question if perhaps regulators' guidelines are too weak in addressing longer term cumulative effects in aquatic ecosystem heath.** For example: Tissue monitoring focuses on metals, which is relatively easy because they bio-accumulate (and thus easy to sample for and measure), but they may not be the problem in the long run. Incremental, negligible changes in PAHs and other organics at sub-lethal level may be a greater threat, and since they do not accumulate like metals, will not show up in tissue sampling.

1) **Issue:** Inadequate Sampling for Benchmarks
   Reference: Aquatic Health
   Concern: According to D. Birkholz (Freshwater Institute, pers. comm.), a bile analysis may be more useful for indicating whether hydrocarbon compounds have been taken up. The problem with trying to monitor PAHs in fish tissues is that persistent but low-level concentrations in the environment are likely to be so low after dilution in a watercourse (unless it is an acute spill) that routine monitoring of the muscle tissue is not likely to pick them up unless exposure has been chronic and long term. Thus, tissue monitoring has severe limitations when it comes to acute detection. Conversely, measuring fish bile for PAH metabolites can provide an indication whether fish have not only been exposed to PAHs, but also have taken them up and metabolized them. It would not be too difficult to collect baseline bile samples from appropriate resident fishes (e.g., suckers, large cyprinids with a modest amount of training) (Spies et al. 1996; Van den Heuvel et al. 1999, Barton 2005). Given the size of Shell's two projects when combined with existing developments (thus, potential risk for inadvertent challenges with runoff is escalated accordingly) this is worth following up on. Pre-development baseline data are needed from fish within the same system for future comparison. **We recommend that the Mikisew Cree request that the Proponent conduct these analyses.**

   Concern is raised that no consideration for sub-lethal effects monitoring (e.g., endocrine disruption) is proposed (by any proponents). Without appropriate baseline data from within the same system, they have no "yardstick" if a major event occurs (e.g., reproductive or year-class failure). We

recommend that the Mikisew Cree request the Proponent measure and monitor for sub-lethal effects.

As with all of these, there is too much reliance on RAMP for determining regional effects. Perhaps CEMA needs to have a bigger role than RAMP in the provision of objective, third party monitoring. CEMA would be a suitable candidate for bile sample baseline and long-term monitoring.

3.4 Air Quality

Key Findings: It appears that ambient monitoring trends from Provincial stations show increasing trends in several compounds that could potentially exceed AAAQO levels for the region. It is unclear if the use of ashphaltene as a fuel has been tested and used elsewhere, whether any direct emission testing has been done or what the emissions look like. Discussions on greenhouse gas management are lacking, as are discussions of contingency plans or mitigation of an increasing trend in odours.

3.4.1 General Comments:

Overall the air quality section for the JEMA and PRMA Project was performed using three case scenarios; a baseline case, an application case, and a planned development case. A good use of cumulative effects was performed to address the differences between the three scenarios (primarily comparisons were drawn between the baseline and application case). Evaluation of ambient contaminates took into consideration 129 separate parameters and has resulted in selected parameters with readings above the AAAQO. However, the overall majority of the modeling predictions were below objectives and screening levels. A good choice of model was used, the 3-D version of CALPUFF model, which is acceptable to AENV according to their air modeling guidelines for both large scale regional modeling and for acid deposition. Several measures and plans have been introduced as potential efforts to limit or decrease future emissions; further reviews should be conducted to ascertain what has been implemented.

Based on the Update information on the EIA it was noted that the exclusion of the Fort McKay Lease would not change the three case scenarios presented in the EIA.

3.4.2 Adequacy of Baseline for Benchmarks

1) **Issue:** Emissions from Mine Fleet
Reference: EIA Volume 3 Air Quality, 3.3.3 Base Case Emissions, 3.3.3.1 Base Case Shell Emissions, pg 3-47
Concern: Comments were raised that oxides of nitrogen (NO_x) emissions from the mine fleet was originally estimated at 11.8 t/d (using current emission standards). Based on the approach used in the Jackpine Mine – Phase 1 EIA, the NO_x emissions were enhanced to account for varying horsepower usage resulting in a lower rate of 11.2 t/d. **It is believed that further reductions can be made with the mine fleets, but are there any procedures or plans to validate these emissions?**

2) **Issue:** Emissions from Traffic and Roads
Reference: EIA Volume 3 Air Quality, 3.3.3 Base Case Emissions, 3.3.3.2 Base Case Regional Emissions, pg 3-47
Concern: It was not clear if road emissions were accounted for by roads / traffic, or simply added in as a background factor. **Please clarify.**

3) **Issue:** Pertaining to Existing Air Quality
Reference: EIA Appendix 3, Appendix 3-7, Existing Air Quality and Meteorology
Comment: There are additional sections of information that consist of reviews of Provincial data from 2001 to 2008, including all stations in the WBEA region. The scope of the research was to determine trends in the Provincial network. As a result, monthly averaged data was used, giving a potential total of 96 data points (months), in comparison to using just 8 data points (years, as was done in this EIA). Only data with >72 out of 96 months of data were statistically evaluated using the Seasonal Kendall Test (and Modified Seasonal Kendall Test) along with Sen's Slope Estimator. If the p-value was <10% (>90% probability), then a statistically significant trend was noted. The results are presented in correspondence to the sections outlined in the review.

4) **Issue:** Upward Trends in SO_2, NO_2, H_2S, THC, and $PM_{2.5}$
Reference: EIA Appendix 3
Concern: We have summarized the ambient monitoring results for several compounds (see Appendix B in this review for more details), showing the increasing or decreasing trends of these compounds. Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Hydrogen sulphide (H_2S), Total hydrocarbon quality (THC), and Particulate Matter Quality ($PM_{2.5}$) have shown significant upward trends. **Does Shell have any plans to address these observed increases? Are there plans to investigate possible reduction measures to limit or stop the increasing trend? The**

trends for PM $_{2.5}$ appear to be more diverse. Are there any contingency plans in the event $PM_{2.5}$ levels begin showing more upward tendencies?

3.4.3 Quantitative Data Collection and Analysis

The air assessment is divided into three case scenarios:

- Base Case "the base case represents the cumulative load on the airshed that can occur in the absence of any additional regulatory approvals" (pg 3-15);
- Application Case "the application case represents the load on the airshed once the project comes into operation" (pg 3-16); and
- Planned Development Case (PDC) includes emissions that are planned and have not received approvals to operate (pg 3-16).

Based on conservatism this assessment was performed assuming "*all developments were operating at their maximum capacity at the same time*" (pg 3-16), which is highly unlikely, but a good conservative approach.

Specific Concerns and Requests

1) **Issue:** Fine Particulate Matter ($PM_{2.5}$) AAAQO
Reference: EIA Volume 3 Air Quality, 3.2.3 Air Assessment Approach, 3.2.3.7 Air Quality Criteria, pg. 3-21
Comment: $PM_{2.5}$ has been assessed based on the Canada-Wide Standard; however, there is an AAAQO and the objective has been in effect since January 2007. From this respect we do not need to look at the 98th percentile averaged over three years; we need to look only at the 24-hr maximum for $PM_{2.5}$.

2) **Issue:** Meteorological Data
Reference: EIA Volume 3 Air Quality, 3.2.3 Air Assessment Approach, 3.2.3.9 Air Assessment Approach, pg. 3-37
Concern: The Air Modelling Methods (pg 3-38) state that only two years of meteorological data are used for this assessment (1995 from BC/AENV, and 2002 from AENV), with local stations used to supplement localized effects. **Why was this format chosen?** According to the modeling guidelines, one year is acceptable, but five years are preferred (three years can be used). In any case, the most recent years and consecutive years of data should be used.

3) **Issue:** Use of Ashphaltene to Fire a Cogen is Questioned Based on Emissions
Reference: EIA Volume 3 Air Quality, 3.4 Air Quality Application Case, 3.4.2 Application Case Emissions, 3.4.2.1 Project Emissions, pg. 3-54
Concern: A point was raised about "*additional thermal energy requirements are being met with asphaltene-fired and natural gas-fired cogeneration facilities*". The use of ashphaltene as a fuel sounds similar to when bitumen fuel was proposed. **Has this been tested and used elsewhere? Is there any direct emission testing that has been done? If so, what do the emissions look like?**

4) **Issue:** Related to Key Question about Effects of the Project
Reference: EIA Volume 3 Air Quality, 3.4 Air Quality Application Case, 3.4.3 Key Question AQ-1: What Effects will the project and the existing and approved developments have on ambient air quality in the region, pg. 3-55
Concern: Based on the difference between the base case and the application case there is an increase of 1.4 to 4.6% in air emissions. This level seems negligible, but already the 24-hr SO_2 and benzene are close to the objective limit (143 µg/m³ prediction/150µg/m³ AAAQO and 29µg/m³ prediction/30µg/m³ AAAQO), whereas NO_2 already shows current exceedances of 24-hr (262 µg/m³ prediction/200µg/m³) and annual (66 µg/m³ prediction/60µg/m³ AAAQO) objectives. As such the effects cause the predictions to get closer to the AAAQO, and in cases like NO_2, just over.

Based on the summary of the Regional Community impacts, specifically at Cabins J, K, and L, which show elevated levels of several pollutants, **has there been complaints or concerns directly from people that own or reside at these cabins?**

5) **Issue:** Comment Regarding Ozone in the Region
Reference: EIA Volume 3, 3.4.5.3 Impact Classification, pg. 3-93
Concern: Shell purports that "*Generally the Oil Sands Region experiences a relatively high background ozone concentration*". Based on current research this statement is not valid. **Can Shell validate this statement or provide the data to support it?** Areas around Western Alberta, not the Oil Sands Region, show high backgrounds of ozone in comparison (Figure 3-2).

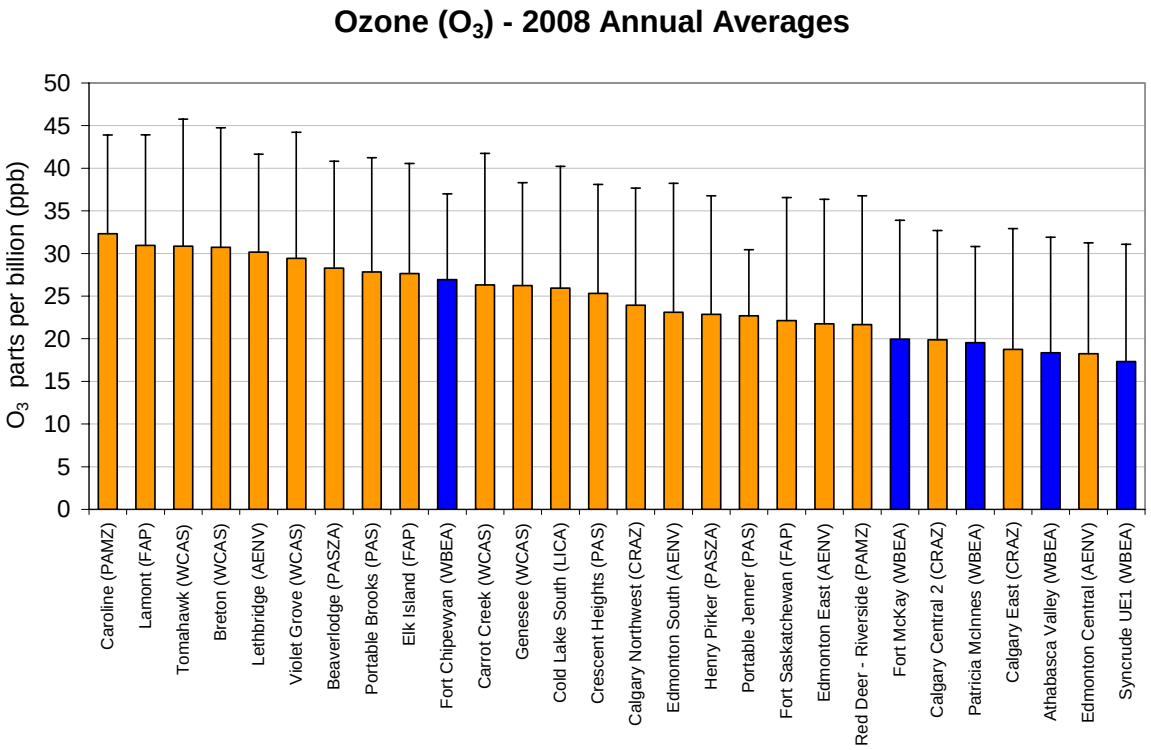


Figure 3-2: Annual Averages for Ozone (O_3) from 2008. Data taken from CASA – www.casadata.org

6) **Issue:** Related to Key Question about Compliance
Reference: EIA Volume 3 Air Quality, 3.4 Air Quality Application Case, 3.4.6 Key Question AQ-4: Will Emissions from the project be in compliance with relevant AENV, EUB and Federal Emission Guidelines, pg.3-94
Concern: There is no mention of the Project adhering to or addressing GHG emissions. **Why was this not addressed under this key question?**

7) **Issue:** Related to Key Question about Odour
Reference: EIA Volume 3 Air Quality, 3.4 Air Quality Application Case, 3.4.7 Key Question AQ-5: What effects will air emissions from the project and the existing and approved developments have on odours in Regional Communities? pg. 3-96
Concern: Shell comments that "*although the changes in the emissions associated with the project are less than 4% of the regional emissions, it is possible to determine the likelihood that odours would be detectable to a typical individual living in the closest regional community receptor.*"

What is an acceptable risk to the population being exposed – if 100 odour complaints have been filed, is an additional 4 acceptable? This has to be raised to the people living under these conditions. The comment focuses on a "*typical individual*" but the odour thresholds can vary

substantially to a sensitive individual. Based on data in Table 3.4-28 (page 3-99), Cabin G is shown to increase in hours of odour exposure from 303 to 307 hours with the application. In addition, Cabin J increases from 108 to 120 hours and Cabin K increases from 96 to 107 hours. **On a percentage basis this is small (~1%), but for an individual living at these Cabins, will the additional 4 to 12 hours of odour actually be only 4 to 12 hours? What contingency is in place for these individual(s) to protect their way of life or ensure that odours will not be rampant for them?**

This is especially true when looking at Table 3.4-29 (page 3-101), which highlights the peak odour predictions; at Cabin G the peak increases from 768 hours (base) to 783 hours (application). These are aesthetic issues and Shell even noted that "*The impacts associated with detectable odours are highly personal and subjective*". **What is the true number of complaints to AENV, ERCB, Municipality, WBEA, etc., on the odour issue? What additional mitigation procedures can be applied to help lower the potential for odour complaints, or address them when they come in? If a large number of complaints are registered, what is the Standard Operating Procedure to address them?**

8) **Issue:** Related to Key Question about Greenhouse Gases
Reference: EIA Volume 3 Air Quality, 3.4 Air Quality Application Case, 3.4.8 Key Question AQ-6: What effects will air emissions from the project have on the production and management of greenhouse gas emissions? pg. 3-102
Concern: This is the first section which addresses the GHG issue (3.4.8.2 Greenhouse Gas Management Rationale). **What plans are in place for "*developing technology to capture and store carbon dioxide (CO_2) emissions from industrial emission sources*"? With many applications being dropped from the Alberta Technology Fund, is CO_2 capture still being investigated by Shell?**

Under section 3.4.8.3 Greenhouse Gas Management Principles, there is no mention of these until page 3-103. **What specifically will be done for these projects, given that the maximum projected operating GHG totals is 5457 kt of CO_2e per year (includes both JEMA and PRMA). Why would Shell consider a dirty technology (ashphaltene fired cogeneration) that would put out an additional 2024 kt of CO_2e per year (without this co-gen the projected operating emissions are 3433 kt of CO_2e per year). What are AENV Climate Change group's comments regarding this?**

Under Section 3.4.8.5 Project Greenhouse Gas Management Plan (page 3-109), the ideas presented are adequate, but as this was the only place these have been noted, **what will be done in practice, and why were they not addressed anywhere else?**

9) **Issue:** Relationship of Ozone to Temperature
Reference: EIA Appendix 3 – Appendix 3-4 Climate Change Considerations in the Environmental Impact Assessment, Section 4 Effects of Climate Change on air Quality Predications, 4.3 Ground Level Ozone, pg. 37
Concern: Data was compared by plotting the daily maximum temperature with the daily maximum ozone. **Did these maximums occur on the same hour? Is a fair comparison being drawn? What does this look like when comparing the maximum ozone with corresponding temperature and maximum temperature with corresponding ozone?**

10) **Issue:** Emission Data for Modelling Scenarios
Reference: EIA Appendix 3, Appendix 3-8, Air Modelling Methods
Concern: This section contains the detailed information used in the modeling of the different case scenarios. The Attachment 1 – Point and Area Source emissions characteristics of the regional developments included in the base case and the application case only identifies the parameters SO_2, NO_X, CO, $PM_{2.5}$, and Volatile Organic Compounds (VOC). **Is there more detailed emission data that has not been included? Please provide the information pertaining to this modelling?**

11) **Issue:** Background Ammonia for Modelling
Reference: EIA Appendix 3, Appendix 3-8, Air Modelling Methods, 3.3.4 Model Options
Concern: It is understandable that ammonia data is limited in this region, but using the lowest background concentration may be underestimating the contribution of ammonia, which can potentially affect the modelling results and the Potential Acid Input (PAI) results. **Is there any indication that actual ammonia data may be collected in the future to address this problem?**

12) **Issue:** CALPUFF Model Inputs
Reference: EIA Appendix 3, Appendix 3-8, Air Modelling Methods, 3.3.4 Model Options
Concern: How many pollutants were modeled using the CALPUFF model? Based on the example shown in Table 9 (pg 39), only six chemical species were used and only three were emitted. **Was this just an example presented and other models were not included? What was the emission properties of the other 123 pollutants looked at in this EIA?**

13) **Issue:** Data Presentation of Maximum Predications
Reference: EIA Appendix 3, Appendix 3-8, Air Modelling Methods, pg. 73+
Concern: There are several tables that present the maximum pollutant (excluding developed areas). It is unclear as to why the data would be presented without the existing open pit mines and upgrading complexes within the RSA (developed areas). **If these facilities are currently present, why remove them from the calculations of maximum pollutants?**

14) **Issue:** Project Emission Sources

Reference: EIA Appendix 3, Appendix 3-8, Air Modelling Methods, Section 3 Emission Source Details, pg. 113

Comment: The emission sources accounted for based on the application case is well defined and encompassing.

15) **Issue:** Upset Flaring

Reference: EIA Appendix 3, Appendix 3-8, Air Modelling Methods, Section 4 Additional Information, 4.1 Upset Scenario 1: Flaring, pg. 133

Concern: Shell comments that flaring should occur once in 11 years and flaring would last for approximately 15 minutes per event. **What happens if this is incorrect or what contingency will be in place to ensure that this is the appropriate time frame?**

16) **Issue:** Potential Acid Input

Reference: EIA Appendix 3, Appendix 3-9, Air Quality Predictions, Section 3 Regional Predictions, 3.3 Potential Acid Input Predictions, pg. 24

Concern: It was noted that emissions from the projects are predicted to increase PAI in 18 of the 20 grid cells used to cover the RSA. Two grid cells exceed the Trigger Level of a Critical Load based on 0.25 keq/ha/yr for sensitive grid cells, with three more cells approaching, but not exceeding, the Trigger Level of Monitoring Load based on 0.17 keq/ha/yr (AENV 2008). Based on this Acid Deposition Management Framework these two cells demonstrate the "*Highest level of deposition that will not lead to long-term, harmful changes to a receptor*", which triggers an Emission Reduction Management (used to implement more restrictive management processes). **Understanding that some reductions are being applied for this project, what else is being done to help restrict this load from increasing? What is being done to help reduce acid forming emissions or restrict emissions to the maximum level possible (Best Available Control Technology - BACT)? If nothing is done, what is the expected timeline before the high buffering capacity of this region can no longer hold the potential load and irreversible effects begin?**

17) **Issue:** Sulphur Dioxide Impacts on Communities

Reference: EIA Appendix 3, Appendix 3-9, Air Quality Predictions, Section 4 Community Exposure Levels, 4.2 Sulphur Dioxide Predictions, pg. 31

Concern: It was noted that the peak exposure was at the Oil Sands Lodge, PTI Camp, and Fort McKay, with all readings within the communities below AAAQO. However it is important to note that based on trending analysis, Fort McKay station has shown a significant upward trend in SO_2 ambient data (as per Seasonal Kendall test for 96 months of data, 2001-2008). **Will Shell increase their monitoring efforts at the Fort McKay station to ensure levels do not keep increasing in concentration?**

18) **Issue:** Nitrogen Dioxide Impacts on Communities
Reference: EIA Appendix 3, Appendix 3-9, Air Quality Predictions, Section 4 Community Exposure Levels, 4.3 Nitrogen Dioxide Predictions, pg. 33
Comment: Unlike the sulphur dioxide readings the peak areas for nitrogen dioxide are below the AAAQO, but are notably higher at Cabins I, J and K, as well as Fort McKay. Also unlike the SO_2 trending analysis the results from the NO_2 trends at the Fort McKay station has shown no significant trend in NO_2 ambient data (as per Seasonal Kendall test for 91 months of data, 2001-2008).

19) **Issue:** Carbon Monoxide Impacts on Communities
Reference: EIA Appendix 3, Appendix 3-9, Air Quality Predictions, Section 4 Community Exposure Levels, 4.4 Carbon Monoxide Predictions, pg. 33
Comment: Based on the predicted CO results the highest impact area is Fort McMurray, which is still below the AAAQO, and may be more related to localized effects rather than regional effects. Trending analysis for CO was performed at the Athabasca Valley station in Fort McMurray, and demonstrated a significant downward trend in CO ambient data (as per Seasonal Kendall test for 91 months of data, 2001-2008).

20) **Issue:** Hydrogen Sulphide Impacts on Communities
Reference: EIA Appendix 3, Appendix 3-9, Air Quality Predictions, Section 4 Community Exposure Levels, 4.5 Hydrogen Sulphide and other Total Reduced Sulphur Predictions, pg. 33
Concern: The peak H_2S predictions indicate potential issues with Cabins J, K, and L. It was understood that maximum values were reported for conservatism; however, both Cabins J and K would be under exceedances of the AAAQO based on the data presented. The 24-hr is substantially less than the AAAQO, which indicates a potential for higher, short duration concentrations (potential odour issues).

If there is a likelihood of increasing H_2S in the region and, noting the excessive number of exceedances (417 in 2008), what contingencies or services will be added to address the potential of future issues, especially for the residents (permanent or not) of Cabins J, K, and L?

There are also higher levels of TRS noted in several communities (Anzac, Fort McKay, Fort McMurray, all cabins (A through L), Oil Sands Lodge, and the PTI Camp). There is no guideline for TRS; however it is sometimes compared to the H_2S objectives. These areas are in levels above the AAAQO for H_2S and these higher, short duration plumes can potentially lead to more odour issues.

21) **Issue:** Volatile Organic Compounds Impacts on Communities

Reference: EIA Appendix 3, Appendix 3-9, Air Quality Predictions, Section 4 Community Exposure Levels, 4.6 Volatile Organic Compounds and Benzene Predictions, pg. 46

Concern: One of the VOCs that has a higher concern is Benzene, which has a 1-hr AAAQO of 30 g/m³. Specifically, the benzene levels in Fort McMurray, which has the highest peak (29 g/m³), may be potentially in exceedance as part of the planned development case. For the other communities, Cabins J and K demonstrate the highest levels of Benzene, but they are still less than the AAAQO.

For overall VOCs the communities that have peaks above 2000 g/m³ are Fort McKay, Cabin G, H, J, K, Oil Sands Lodge, and PTI Camp. Overall the maximum impacts are at Cabins J and K. VOC trending was not performed, but THC is reported to CASA and seven stations demonstrated significant upward trends in the ambient air over the last eight years. Based on the overall trend data there is an indication of an overall regional increase of THC. **What does Shell propose to potentially reduce the upward trend of THC?**

22) **Issue:** Particulate Matter ($PM_{2.5}$) Impacts on Communities

Reference: EIA Appendix 3, Appendix 3-9, Air Quality Predictions, Section 4 Community Exposure Levels, 4.7 Fine Particulate Predictions, pg. 100

Comment: The $PM_{2.5}$ profiles demonstrated the maximum peak impacts were located at Fort McKay, Cabins D, E, F, G, I, J, and K, Oil Sands Lodge, and PTI Camp. Important to note is that the peak (maximum $PM_{2.5}$) was located at Cabin J, at a level of 688g/m³. Whereas, the 98th percentile peak occurred at Fort McKay, with a level at 25g/m³. Particulate trending indicates there is no clear overall regional increase, but there are site-specific increasing and decreasing trends. Millennium and Syncrude UE1 demonstrate the only significant upward trends in the region.

23) **Issue:** Trace Air Compounds Impacts on Communities

Reference: EIA Appendix 3, Appendix 3-9, Air Quality Predictions, Section 4 Community Exposure Levels, 4.8 Trace Air Compound Predictions, pg. 100

Concern: Based on the profiles for PAHs the region that demonstrates the highest carcinogenic PAHs is the area encompassing Cabin J and K, and Oil Sands Lodge. As there is no guideline to compare against, it is important to note the peak regions. Based on the 19 heavy metals presented, there are guidelines and objectives for all but two of them. When comparing the predicted levels at the community sites the heavy metal that appears close to a guideline level is cadmium, which has a Texas Commission on Environmental Quality Effects Screening Level (Texas Commission on Environmental Quality 2009). Based on this level the Oil Sands Lodge has an application level of 0.08 g/m³ and a planned development level of 0.15 g/m³, with the TESL at 0.1 g/m³ per hour. **Where are the source profiles for these heavy metals based on emissions? How many sources of these heavy metals were used?**

3.4.4 Quantitative Monitoring and Using Targets

1) **Issue:** General Comment on Predicted Emissions in Overview
Reference: EIA Summary, Section 17.2 Air Quality, pg. 17-10
Concern: In general it was noted that increases of SO_2 as a result of the Project is estimated to be 2.9%. **With readings already noted above AAAQO in the region occurring for these species, is it fair to assume that the increase, even though small, can potentially lead to more exceedances in the region?** In addition, the summary tables (Table 17-2, pg 17-11 as an example) do not address when there are readings "near" the AAAQO, rather just if there are exceedances. This point is raised because of readings such as the 24-hr NO_2, which has a projected reading of 182 (the objective is 200 µg/m^3). No exceedances occur, therefore there is no comment. **How close do you allow before commenting on the value?**

2) **Issue:** Mitigation, Monitoring and Management of GHGs
Reference: EIA Summary, Section 17.2 Air Quality, pg. 17-13
Concern: The Section on Mitigation, Monitoring, and Management addresses several good points for reduction potentials and policy incentives; however there was no mention of GHGs. **Why was there no mention of plans or reduction potentials to ensure compliance with CO_2 policies as per directions of AENV Climate Change Policy Unit and the Federal Government?**

3) **Issue:** Related to Planned Development Case (Future Emissions)
Reference: EIA Volume 3 Air Quality, Section 3.5 Air Quality Planned Development Case, pg. 3-112
Concern: Shell comments that "*the emissions that actually occur in the future may be lower than the estimated PDC emissions*." **This should also read that emissions could be higher as well.** This is important when looking at the possible level of SO_2 and NO_2 predictions, which outline a potential for exceedances on the 1-hr, 24-hr, and annual levels. It appears like these exceedances are planned when Shell comments - "*it is predicted to exceed only 0.9% of the time (78 hours per year)*." This comment makes it appear that exceedances have become acceptable practice and that it is okay to allow these exceedances to happen. **Based on these predicted exceedances, what is Shell going to do to reduce them?**

It is anticipated that the fleet emissions will drop substantially after the 2011 standards come into effect. **What is in place to ensure that a fleet retro-fit or change is going to be done?**

4) **Issue:** Upset Scenarios
Reference: EIA Appendix 3, Appendix 3-8, Air Modelling Methods, Section 4 Additional Information, 4.3.2 Upset Scenario 3: Model Results, pg. 138
Concern: Based on the predicted modeling results from the scenario 3, elevated peaks and maximums demonstrate large impacts, especially at Cabin H and Cabin K. **What plans are in place to warn the people of these locations that there is a potential problem that could impact their location (specifically based on upset scenarios)?**

3.4.5 Addressing Stakeholder Concerns

Concerns were raised about the increases in air emissions related to increased activity (EIA Volume 3 Air Quality, 3.3.2 Traditional Ecological Knowledge, pg 3-45). One of the most distinct issues is related to odour. Based on current data from the region there have been several H_2S exceedances, which may or may not relate to odour, just that there have been 1141 exceedances from 2004 to 2008, and 417 in 2008 alone. **Having grounds for potential odour issues, are there any standard protocols that will help follow-up in relation to odour issues raised in the region?**

3.5 Closure, Conservation & Reclamation

3.5.1 Monitoring & Follow Up Programs

Key Findings: The input provided by the Mikisew Cree to date is not meaningfully integrated in any part of the approval process. Consequently, the Mikisew Cree has not been allowed to contribute to the process of designing the operational, environmental and reclamation plans of the two projects. Neither the Approval 20809-01-00 nor the Monitoring programs and reports submitted thus far provide the necessary detail to evaluate the effectiveness of mitigating the impacts on TLU.

3.5.1.1 General Comments

Impact predictions, no matter how solid, need to be tested during monitoring and follow-up programs (Morrison-Saunders and Arts 2004). Shell correctly states that the "*understanding of potential environmental effects [needs to be] validated by … environmental monitoring*" (Vol.1, Section 1.3, p. 1-21). Shell also states that "e*ffective environmental management requires a comprehensive understanding of baseline environmental conditions*" (Vol.1, Section 1.3, p. 1-21). For a comparison with baseline data and for the detection of effects that were not predicted, the most fundamental necessity is that both the baseline and the monitoring information must be quantifiable. For a useful monitoring program, testable questions must be developed (Burns & Wiersma 2004). Because of this fundamental necessity to provide more certainty in the future environmental management of the proposed project, we build the

comments below on the need to provide a foundation for the testable questions that must be developed for the potential future monitoring programs. This foundation is currently weak throughout the EIA. If this weakness is not addressed before the project is initiated, then it may never be possible to verify the validity of the impact predictions and test the effectiveness of mitigation measures.

Moreover, in August 2007 the Mikisew Cree made recommendations on the proposed ToR and raised the overarching concerns that "it is not clear how the proponent and GoA will rise to the task of determining the relative "success" and "effectiveness" of reclaiming the landscape and subsequent wildlife recolonization over time" (MSES 2007). The following points and recommendations, relevant to the monitoring and follow-up, have been submitted:

- *The most significant concern is that there is no provision that would require the development proponent to collect data on wildlife species or populations that would ensure the establishment of quality baseline information that could, and should, be comparable to the results of future monitoring programs over the entire lifetime of the Project.*
- *The EIA will discuss "a conceptual schedule for the return of the forest resource landbase by area, species and productivity". Please include a condition that the EIA should discuss benchmarks for reclamation (such as the density of plant species, 5 years, 10 years, and 20 years post reclamation) and potential adaptive managements if benchmarks are not met.*
- *The ToR pledges to discuss "plans to monitor biodiversity in the reclaimed landscape, considering the use of control sites as benchmarks for comparison with reclaimed areas, and using Alberta Biodiversity Monitoring Program protocols, as practical." The ToR should make a commitment to the use of control sites as benchmarks for monitoring biodiversity, rather than simply considering the use of benchmarks. The wording is so vague and open-ended that the proponent does not actually have to* ***do*** *anything, only* ***consider*** *the possibilities.*
- *"Baseline information collected in each terrestrial and aquatic vegetation community will be accompanied by sufficient plots in each ecosite phase to provide reliable data using a suitable proportional sampling method and to provide a measure of biodiversity on baseline sites that are representative of the proposed reclamation ecosites;" In order to understand the natural variability of biodiversity measures within ecosites, sufficient control plots should be established at baseline and monitored throughout the project lifetime and closure. Having measures of natural variability of biodiversity from control sites would provide a basis for determining whether measures from reclaimed ecosites fall within the natural range of variability of local undisturbed ecosites.*
- *The ToR makes no reference to participation in regional monitoring of either groundwater quality or quantity. In contrast, the surface water resources section includes details or proponent participation in regional monitoring programs such as CEMA and RAMP. It is noted that recent approvals from AENV have included*

requests for participation in regional groundwater quality monitoring. Please consider including regional groundwater quality monitoring in the ToR and regional groundwater quantity monitoring as well.

- *The groundwater monitoring and remediation plan requested in the Appendix is a fine idea but requires the identification of the "trigger values" for key parameters, as noted in item 5.6.5 (f). Such requirements are typically provided in the Groundwater Monitoring Proposal that is typically requested once an approval is issued. However, there is no reason why monitoring and contingency planning not be included in the initial EIA document. Please consider adding this as a condition to the ToR. This would provide a more complete picture during future reviews as these plans provide critical information specific to the methodology for groundwater protection*
- *Please add the following condition: "The EIA report will…b) present: … v) data that are gathered through monitoring, modelling and assessment should be made available to a central data warehouse, which should be accessible to all stakeholders for review, analysis and discussion.".*

Although the Mikisew Cree submitted its recommendations for input into the design of the EIA, their overarching concerns have not been alleviated by the EIA. The GoA believes that EIAs should only be conceptual documents (AENV 2009, p.2):

> *Consistency with the overall intent and scope of EIA reports, the intent being that EIAs are written at a conceptual level. The detailed information is provided in the associated regulatory approval applications.*

The reliance on a conceptual level of information could only be upheld if indeed there was support for the second sentence of this guide, namely that detailed information would be provided at the approval stage. This is not the case. We show below that neither the Approval 20809-01-00 nor the Monitoring programs and reports submitted thus far provide the necessary detail to evaluate the effectiveness of mitigating the impacts on TLU.

3.5.1.2 Example quotes from Approval 20809-01-00

6.1.44 The Revegetation Plan … shall include, at a minimum, all of the following:

(a) forest ecosystems and wetland ecosystems on disturbed land:

(i) incorporation of vegetation and vegetation communities of traditional value that are characteristic of the locally common boreal forest;

(ii) re-establishment of the capability for long term biodiversity consistent with the Biodiversity Program referred to in subsection 6.1.7980;

(iii) re-establishment of the continuity of vegetation patterns, where practicable, between the reclaimed lands and adjacent undisturbed lands;

6.1.53 The plan referred to in subsection 6.1.52 shall comply with Guideline for Wetland Establishment on Reclaimed Oil Sands Leases, 2000, as amended, and shall include…

Contrary to the assurance in the Guide to Providing Comments on Proposed Terms of Reference (AENV 2009), the above approval terms and conditions are conceptual only, not detailed. Moreover, the approval requires the re-establishment of wetlands but none of the natural wetlands will be re-established ((JPM-Phase 1 and Expansion Vol. 5, App. 5-1, Sec 2.3.2.3, pg 64, Table 17; PRMA Vol. 5, App. 5-2, Sec 2.3.3, pg 56, Table 7).

6.1.69 The approval holder shall continue to participate in research programs through CEMA, CONRAD, or any other initiatives, … shall include at a minimum all of the following:
(b) demonstration of whether the plant community structure of reclaimed sites is converging with that of native sites, for the range of natural ecosites a-f

Note that this requirement only addresses ecosites a to f which are upland vegetation types. Even so, to date, such a demonstration has not been provided by any of the Oil Sands operators in the region since the beginning of oil sands operations over 40 years ago. The annual monitoring programs submitted by Shell do not provide any information that would be useful in developing such a demonstration.

6.1.70 The approval holder shall re-establish moose, fish and other wildlife habitat levels, at a minimum, similar to that which existed prior to disturbance, in proportions appropriate relative to the approved Life of Mine Closure Plan.

6.1.71 The approval holder shall demonstrate, through monitoring, progress in achieving the moose, fish, and other wildlife habitat levels as outlined in subsection 6.1.70.

6.1.72 The approval holder shall re-establish a diversity of wildlife and fish habitats similar to those that existed prior to disturbance, in proportions appropriate relative to the approved Life of Mine Closure Plan.

6.1.73 The approval holder shall demonstrate, through monitoring, progress in achieving a diversity of wildlife and fish habitats as outlined in subsection 6.1.72.

6.1.74 The approval holder shall document wildlife and fish habitat utilization on the reclaimed land by monitoring wildlife and fish species typically associated with and naturally occurring in the wildlife and fish habitat types present.

Having reviewed numerous approvals and monitoring reports, we have not yet found any example that would actually satisfy approval terms and conditions, such as the above, which require that the habitat and its use by wildlife needs to be re-established and that the success of such re-establishment needs to be demonstrated. The lack of such demonstration presumably rests on the vague terms and conditions

that do not prescribe what the target is against which success needs to be measured. The information provided in Vol. 5, Appendix 5-6, pg. 10-11 presents equally vague and conceptual promises.

We recommend that AENV explain how and when the Approval terms and conditions will become sufficiently concrete to assure that the Mikisew Cree will be accommodated and that the continued exercise of their Treaty Rights will be protected.

3.5.1.3 Example quotes from reviewing monitoring reports by Albian Sands:

In Mikisew Cree's review of the annual report 2007:

"Demonstrating progress is an overarching requirement of the Approval, yet we are left wondering what the numbers of trees and shrubs that have been planted mean in terms of the desired success. Consequently, the effectiveness of mitigation relating to returning to pre-disturbance conditions cannot be evaluated at this point in time."

In Mikisew Cree's review of the annual report 2006:

"Information on several aspects of ecosystem re-establishment and reclamation success is identified, yet targets are not presented for any discipline. The effectiveness of mitigation cannot be determined because neither regional nor project specific targets and impact predictions are identified. Without setting targets, it is unclear how progress will be measured or success of mitigation will be demonstrated. "

"It is unclear how well the condition of the regional aquatic environment is indicated by the "sensitive biological indicators" and how far away this condition is from the target."

"The Report does not indicate precisely how Albian contributes to the regional initiatives, how it benefits from these initiatives in terms of receiving guidance for its environmental management, or how it will transform regional research into environmental management guidelines."

It is evident that the monitoring reports do not assist in a concrete (as opposed to conceptual) understanding of the re-establishment of traditional resource use. These reports do not support the assertion by AENV that "*The detailed information is provided in the associated regulatory approval applications."*

We recommend that AENV develop terms and conditions of approvals that require specific parameters to be measured during monitoring so that the proponent concretely demonstrate the success of re-establishing traditional resources.

3.5.1.4 Adequacy of Baseline for Benchmarks

Data on vegetation communities are available although some inappropriate analysis of baseline data and inadequate sampling in some ecosites has been noted by the reviewers. However, it is useful to know how much of each ecosite is there now and how much will be there after closure. This direct comparison is provided in the Conservation and Reclamation (C&R) plans of Volume 5 (see Section below on "Quantitative Monitoring and Using Targets"). In general terms, after closure there will be about 40% more upland and 20% more lakes in the reclaimed landscape. However, about half of the wetlands will be lost. At present, it does not appear that FN input was used in determining some of the reclaimed ecosite scenarios.

We recommend that **the Mikisew Cree is invited to comment on what the reclaimed vegetation scenario means to continuing their traditional resource use. Please discuss how the removal of wetland ecosites from the landscape for both the JEMA and the PRMA may alter the landscape, and hence, Traditional Land Use.**

Disciplines other than terrestrial ecology noted that there were areas of weakness and gaps in information on baseline conditions. Few, if any, links were established between baseline TR and surface water quantity or soil moisture, or ground water and air quality. **In order to complete a concrete plan on the re-establishment of Traditional Resources, Shell should document its understanding of how water resources after mine closure will accommodate traditional resource use, compared to baseline conditions. Furthermore, Shell should discuss with the Mikisew Cree how its plan will protect the continued exercise of Treaty Rights.**

3.5.1.5 Quantitative Data Collection and Analysis

Shell provides an outline of methods that they may use for the monitoring programs in all disciplines, aquatic and terrestrial. It was promising to see that the wetland monitoring program provides a general schedule for sampling (following Project approval and every two years after), but details on what will be sampled and how the data will be analysed are still missing. Moreover, details such the sampling schedule, location, and frequency are lacking for the wildlife and other monitoring programs. For example, Shell states that for wildlife they will consider several techniques, such as winter track transects, remote camera plots, and wildlife backtracking for the wildlife corridor monitoring program. The discussion of how wildlife will be monitored focuses on what the Proponent will consider to do rather than what they will actually do. One would expect in Vol. 5, Appendix 5-6, Terrestrial Monitoring Programs, that some concrete methods for measuring the effectiveness of the mitigation would be presented for all disciplines. A discussion of measuring mitigation of each of the effects on Treaty Rights is not provided.

We recommend that Shell uses its own experience in the oil sands and its own methods and approaches that are already developed, and discuss with the Mikisew Cree how it intends to use this experience in developing concrete monitoring programs that test the effectiveness of mitigation. The mitigation should accommodate the FNs concerns. Shell should explain why it did not apply its concrete experience of the past programs and why only conceptual programs were presented in this EIA. In doing so, Shell forfeited the opportunity to discuss real and concrete actions and steps towards follow-up programs at this early stage of development. Shell stated throughout the disciplines that it will develop details later, presumably after the approval is granted.

3.5.1.6 Quantitative Monitoring and Using Targets

More to the point on forfeiting the opportunity to discuss concrete monitoring plans with the FNs, Shell provides few examples were concrete targets can be used to test the predicted effectiveness of mitigation. Shell provides pre-disturbance vegetation data in the C&R section, along with the reclamation targets (JPM-Phase 1 and Expansion Vol. 5, App. 5-1, Sec 2.3.2.3, pg 64, Table 17; PRMA Vol. 5, App. 5-2, Sec 2.3.3, pg 56, Table 7). With this useful information, in an instant, readers can see clearly how the reclamation areas compare to the pre-disturbance landscape and how reclamation is proceeding.

The disconcerting part is that this useful information may actually never be applied. Shell purports that the design of the monitoring programs will be an extension of the monitoring programs "*designed and conducted for the Muskeg River Mine (MRM), and its Expansion (MRME) and Jackpine Mine –Phase1*" (App 5-6, Section 4.2). Shell also participates in several "*regional initiative programs that provide monitoring and research information*" and produces an annual C&R report that summarizes the reclamation activities and research. Given the many years of Shell operations in the area, one would expect that concrete monitoring programs based on targets, benchmarks, and progress to measure the effectiveness of mitigation measures would be available (App 5-6, Section 4.2).

It is disappointing to see the monitoring programs being described at this point as only conceptual in design. More perplexing, the monitoring programs that Shell intends to build on do not show any concrete baselines, even though, as Shell states, "*effective environmental management requires*" them (Vol. 1, Section 1.3, p.1-21). For example, the MRM monitoring report of 2007 shows the following results (Figure 4-2, Table 4-7, and Table 8-1 below are taken from Albian Sands Energy Inc. (2007)):

FIGURE 4-2 VEGETATION DISTRIBUTION BY FUNCTIONAL GROUP ON THE RAW WATER INTAKE RECLAMATION AREA

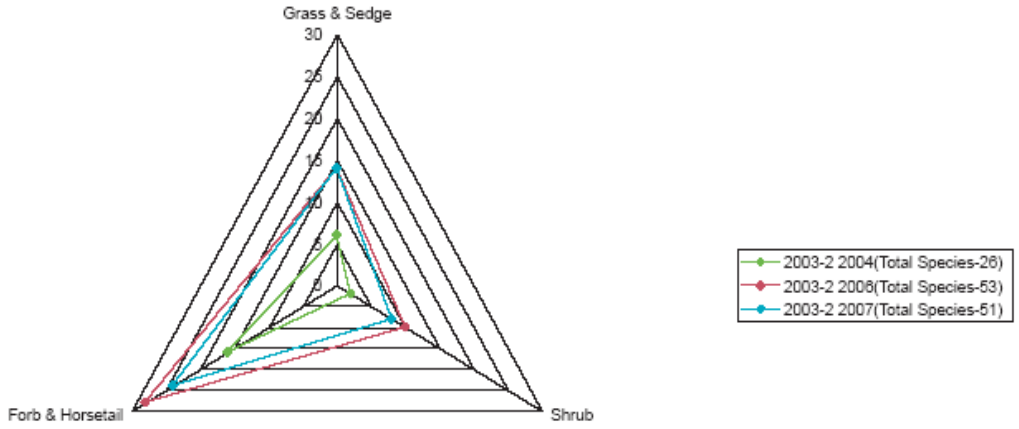


TABLE 4-7 REVEGETATION ACTIVITIES. 2007 ACTUAL continued from previous page

		2007 ACTUAL				
LOCATION	LOCATION DESCRIPTION	AREA (HA)	NURSE CROP (HA)	GRASS (HA)	SHRUBS (#)	TREES (#)
Revegetation – Temporary	Raw Water Intake – Surrounding Well & Adjacent to Highway 63	–	–	–	–	–
	Raw Water Intake Corridor	–	–	–	–	–
	Cooling Tower Slope	–	–	–	–	–
Revegetation – Permanent	Muskeg River Bridge (ERA #2)	–	–	–	–	–
	Old Access Road – South of Pond 3 – LOC 5732	–	–	–	–	–
	Old Access Road – PTI Loop – LOC 5732	–	–	–	–	–
	SW Disposal Area – Toe	–	–	–	–	–
	NE Overburden Disposal Area – South and East Toe Berm	3.5	–	–	2,835 buffaloberry, 1,555 alder	1,570 white spruce,
	Tailings Dyke – Toe	–	–	–	–	–
Revegetation – Research	Instrumented Slope Facet	0.5	–	–	–	–
	Shallow Stripping Material Test Plot	1.6	–	–	810 buffaloberry, 230 dogwood 146 pin cherry, 1,350 alder	633 jackpine
Total Revegetation		5.6	0.0	0	6,326	2,203

TABLE 8-1 2007 WILDLIFE SIGHTINGS SUMMARY

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Mammalian													
Moose	4	5	9	12	16	5	5	3	0	10	2	4	75
White-tailed Deer	3	2	1	15	6	8	7	0	5	3	7	40	97
Red Fox	9	1	2	1	23	26	30	23	15	24	12	49	215
Wolf	2	2	1	0	1	1	1	0	0	1	5	9	23
Coyote	5	3	5	1	2	15	21	6	15	14	3	5	95
Black Bear	0	0	0	0	16	0	14	8	2	4	1	0	45
Cougar	0	0	0	0	0	0	1	0	0	1	0	0	2
Beaver	0	0	0	1	1	0	0	0	0	0	0	0	2
Muskrat	0	0	0	1	0	0	1	0	0	1	0	0	3
Meadow Vole	0	0	1	0	0	0	0	0	0	0	0	0	1
Mink	0	0	0	0	0	0	0	0	0	0	0	1	1
Weasel*	0	0	0	0	1	0	0	0	0	0	0	0	1
Rabbit*	0	0	0	0	0	0	0	1	2	0	1	0	4
Bat*	0	0	0	0	0	0	0	0	0	0	1	0	1
Sub-Total	23	13	119	31	66	55	80	40	37	58	30	107	559
Amphibian													
Boreal Chorus Frog	0	0	0	2	0	0	0	0	0	0	0	0	2
Wood Frog	0	0	0	0	0	2	0	0	0	0	0	0	2
Sub-Total	0	0	0	2	0	2	0	0	0	0	0	0	4
Avian													
Crane*	0	0	0	0	4	0	0	0	0	0	0	0	4
Owl*	1	0	0	0	0	0	0	0	0	0	0	0	1
Duck*	0	0	0	4	18	0	7	15	3	0	0	0	47

(This table truncated from original)

The information presented in Albian's 2007 Environment Report may be well intended, but it does not show the success or effectiveness of mitigation, which is one of the primary and legislated objectives of monitoring programs. Readers of the monitoring report do not know which forb, grass, sedge, and shrub species are present near the water intake reclamation area. **Does the number of species, species composition, and percent cover of each species at this reclamation site resemble any particular pre-disturbance ecosite? What ecosites were present in the pre-disturbance landscape and how much of the area did each ecosite cover? What are the target ecosites and how much area will each targeted ecosite cover?** We can see that some revegetation activities occurred in 2007; the number of trees and shrubs planted looks impressive. However, we do not know the survival rate of each species and therefore how many trees and shrubs will survive beyond the year planted. **Also, why were only three and five 5 species planted at each site, when pre-disturbance ecosites were much more diverse?** For wildlife, the only meaningful information provided in the Table is that several species have been observed. However, we do not know how they were observed, how much effort was put into the observations, or under what conditions. The information provided does not put the wildlife sightings into the context of "*demonstrating wildlife habitat use re-establishment*". **What is the expected wildlife habitat use? What is the expected species distribution and abundance?**

The above discussion and examples show that Shell's current monitoring and follow-up programs do not provide the details required by the Mikisew Cree to understand the effectiveness of mitigation. Also, it does not meet the requirement of the Approval. The monitoring programs are conceptual in the EIA stage and they remain conceptual through the follow-up stage. We recommend that **Shell provide a concrete, not conceptual, monitoring plan that quantifies mitigation success, of which reclamation is a major part. This must include evidence that progress is being made towards reclamation targets using all proposed mitigation measures. Moreover, the progress being made with respect to reclamation needs to be demonstrated in terms of traditional resource use.**

Shell claims that wildlife recolonization will occur in a "*predictable progression*" of species in response to the newly-revegetated area (Vol. 5, Appendix 5-2, Section 2.5.3). **If this progression of wildlife recolonization is predictable, then please provide:**

1) **evidence that wildlife habitat utilization has been re-established**, "*similar to that which existed prior to disturbance" (Quote from Approval 20809-01-00)*, **anywhere in any operation of the oil sands region**

2) **targets for wildlife habitat use and distribution after successful reclamation applied in Shell's monitoring programs**

3) **measures of successful re-establishment of wildlife habitat utilization applied in Shell's monitoring programs**

4) **a demonstration that the reclaimed landscape will allow the continued exercise of Treaty Rights.**

Alternatively, if such evidence and concrete targets and measures cannot be provided, please engage in dialogue with the Mikisew Cree to establish a process by which traditional land use can be re-established, setting up the required concrete and detailed plans to protect the continued exercise of Treaty Rights.

We highlight the deficiencies in monitoring of terrestrial ecology parameters because approval guidelines do not appear to treat terrestrial ecology with as much quantitative rigour as they do for water and air quality. More to the point, we highlight the deficiencies in terrestrial ecology follow-up programs because TLUs is directly affected by the distribution and viability of wildlife and vegetation species in the region.

3.5.1.7 Addressing Stakeholder Concerns

Treaty Rights need to be protected and accommodated at the early stages of strategic decision making (Passelac-Ross & Potes 2007). Shell presents the consultation input and actions from consultation meetings with various groups, the Mikisew Cree included. The two action items from Table 2 in C&R – JPME and Table 2 in C&R-Pierre River that involve the Mikisew Cree are:

- MCFN participate in End Land Use Planning; and
- participate in a tour of the facilities.

These two action items arose from consultation with the Mikisew Cree, but they do not address issues that the Mikisew Cree have been raising in previous phases of the regulatory process (see list in Section 3.5.1.1 above). And, they refer almost exclusively to activities that will be conducted only after the projects are in operation. Neither the end land use planning (that may occur at some future date) nor the tour of the facilities involves the Mikisew Cree in strategic decision making. Above we raised some of the numerous comments and recommendations that the Mikisew Cree already submitted throughout the permitting process for the JPME and PRMA, none of which appear to be incorporated in this EIA or in the future follow-up programs. A case in point is the finding that traditional use plants were not included in reclamation planning (see Reclamation Section 3.5.2 in this review). Given current planning, reclamation areas will have relatively few traditional plant species after development.

As such, **the EIA for the JPME and PRMA has not addressed Mikisew Cree concerns. Please explain how Shell intends to first collect, and then integrate, comments submitted by the MCFN in the strategic and operational plans of these two projects.** In Table 2 of the C&R Plan Shell commits to a meeting reviewing the "C&R commitments." We urge that this meeting be set up as a dialogue, allowing for the integration of Mikisew Cree comments in the design of follow-up programs.

We recommend that Shell explain how it intends to use the input already provided by the Mikisew Cree. Traditional land use and its re-establishment must be specifically highlighted in Shell's operational plans, including scheduling, progressive reclamation, design of reclamation programs, and monitoring of reclamation.

3.5.2 Reclamation

Key Findings: The goal of re-establishing "equivalent land capability" is too vague to understand how TR will be re-established. Areas of traditional plant potential were only indirectly included in reclamation planning. Only a small number of species will be planted, and only a few ecosites are planned for the reclamation landscape. It is not stated how these species and ecosites will serve to protect the practice

of Treaty Rights. It is an unsupported assumption that many plant species will establish naturally into reclaimed areas over time through successional processes.

3.5.2.1 General Comments:

Overall there are some issues relating to the adequacy of the baseline data (see Section 3.2.2 in this review), a lack of specific details, including targets, in the monitoring program, and serious flaws in the approach to reclamation.

Few specific details of the monitoring program are provided, making it difficult to evaluate and specific targets to define reclamation success are not provided. **Please provide more specific targets, for the mean number of species, species composition, and percent cover of species within each ecosite/wetland type so that the success of reclamation can be fully evaluated.** In addition, the primary methods for reclamation are flawed, which leads one to wonder if success will be achieved. The main problem lies in the beliefs, unsupported by evidence, that plant species will become established in reclaimed sites over time through "*successional processes*" and by the emergence of plant species from the reclamation material (LFH). By not planting a wide range of species in the initial period of reclamation, it is unlikely that the ecosites targeted for reclamation will bear any resemblance to pre-disturbance ecosites.

Traditional plant potential was assessed in the EIA, including traditional plant richness and traditional plant species. However, errors in classification (i.e., burn areas) mean that areas of low, moderate, and high traditional plant potential need to be recalculated and the effects of the Project on traditional use plants reassessed. **Will the Proponent recalculate areas of low, moderate, and high traditional plant potential after reclassifying burn areas?**

Also, the effects of dust on traditional use plants were not assessed directly. **Please discuss why traditional use plants were not included in reclamation planning directly.** If reclamation proceeds as indicated in the EIA, reclamation areas will have relatively few traditional plant species after development.

3.5.2.2 Adequacy of Baseline for Benchmarks

Some aspects of the baseline data are problematic and affect their use as a foundation for impact predictions (please see discussion in Section 3.2.2.2 of this review).

3.5.2.3 Quantitative Data Collection and Analysis

Methods of data collection, including the number of detailed vegetation samples, were appropriate in both the JEMA and PRMA LSAs. However, the distribution of sample plots is not adequate (see discussion in Section 3.2.2.3 of this review).

3.5.2.4 Quantitative Monitoring and Using Targets

Few specific details of the monitoring program are provided, making it difficult to evaluate. Some specific targets to define reclamation success are provided; however, there are too few details to fully evaluate the success of reclamation.

Targets for the closure landscape can be compared to the baseline ecosites and wetlands found in the LSAs. The amount of area in each ecosite and wetland type in the existing LSAs and area of each ecosite/wetland type predicted in the closure landscape are provided in Table 11 (JP Mine Phase 1; App 5-1, Sec 2.3.2.1, pg 58), Table 14 (JEMA; App 5-1, Sec 2.3.2.2, pg 61), Table 17 (JP Mine Phase 1+JEMA; App 5-1, Sec 2.3.2.3, pg 64) and Table 7 (PRMA; App 5-2, Sec 2.3.3, pg 56). The targets for the closure landscape differ from baseline conditions mainly because most peatlands disturbed by the Project cannot be reclaimed to peatlands and some existing disturbances will be reclaimed to primarily native ecosites, with some wetlands (marshes will be created). The Alberta Conservation and Reclamation Regulation requires that disturbed lands are returned to equivalent land capability, which is one of the targets of reclamation in the EIA. Targets are not provided specifically for TR (i.e., traditional use plants). This information could be derived by examining the ecosite/wetlands to be reclaimed.

Specific Concerns and Requests

1) **Issue:** Description of Monitoring Design
   Reference: Volume 5, Appendix 5-6, Section 3
   Concern: "*The vegetation monitoring program is designed to evaluate the success of reclamation procedures over time..*" and to meet the objectives of "*species composition*," including "*planted species and non-planted native species.., and species composition is progressing towards target ecosystems as expected (e.g., ,tree density, tree survivorship rate, tree height and condition)*". "*Reclamation will be evaluated through annual assessments*" and the design of the monitoring program will be "*adapted from the AENV Forest Management Branch Regeneration survey manual (AENV 2000).*" **What are the objectives of species composition? How does one know if species composition is "progressing" towards target ecosystems?**

   For wetlands monitoring, the following parameters will be monitored at each site: "*plant species composition, percent cover, water table depth, water chemistry, soil profile and classification, and appearance*

(as recorded in photos). *These parameters will be measured every year for the first two years, and then every two years after that for the life of the project.".* **How many vegetation and wetland sites will be monitored? Will the full range of ecosite/wetland types planned in the closure landscape (as indicated in Tables 7, 11, 14, and 17 in App 5-1 and 5-2) be monitored? What are the targets or thresholds for tree density, tree survivorship, tree height, tree condition, plant species composition, height, percent cover, and vigour that would indicate the achievement of reclamation procedures over time?**

2) **Issue:** Closure Landscape Predictions
Reference: Section 2.3 in Appendices 5-1 and 5-2, Volume 5, Tables 7, 11, 14, and 17
Concern: In the Terrestrial Impact Summary, tables provide the target ecosite/wetland types predicted for the closure landscape of PRMA, Jackpine Phase I, JEMA, and JEMA and Phase I. These tables provide a list and the area of the existing ecosite/wetland types in the LSAs and the predicted area of the ecosite/wetland types to be reclaimed in the closure landscape (i.e., after successful reclamation). **Why are these tables not provided and discussed in the C&R plan, as they will be useful in developing some predictions about reclamation success that can be tested, supported, or rejected by the results of the monitoring program?** Yearly updates could provide the area in each target ecosite/wetland type that has been successfully reclaimed.

In addition to data on the predicted area in each reclaimed ecosite or wetland type, the EIA provides, for each pre-disturbance ecosite and wetland type, the vascular plant species diversity in the JEMA LSA (TES, Table 3.5-9) and PRMA LSA (TES, Table 3.6-8) as well as mean vascular plant, mean bryophyte, and mean lichen species richness in the JEMA LSA (Table 3.5-10) and PRMA LSA (Table 3.6-9). These data, in addition to species composition and percent cover data that was collected in the detailed vegetation plots (TES, Section 3.3) could be used to further develop predictions that could be tested, supported, or rejected by the results of the monitoring program (i.e., evaluating the success of reclamation). Similarity coefficients could be used to compare pre-disturbance and reclaimed ecosites/wetland types in terms of these parameters. Then targets of similarity in terms of these parameters could be developed such that the success of reclamation could be evaluated for each ecosite/wetland type. **Will the Proponent use similarity coefficients to assess the similarity between each pre-disturbance and reclaimed ecosite/wetland types in terms of mean species richness (all plant types), species composition, and percent cover in each ecosite/wetland type? Will targets of similarity be established for each parameter so that the success of reclamation can be evaluated?**

3) **Issue:** The Number Ecosite/Wetland types Targeted for Reclamation in the Project LSAs
Reference: Volume 5, Appendices 5-1 and 5-2, Section 3
Concern: "*Inherent in Shell's mine reclamation planning efforts are to maintain the area's biodiversity ...*"
In the existing landscape, there are 32 ecosite/wetland types (excluding burned uplands and

lowlands) in the JEMA LSA (Vol 5, App 5-1, Table 14, pg 61) and 41 ecosite types in the PRMA LSA (Volume 5, Appendix 5-2, Table 7, pg. 56). However, there are only 12 ecosite/wetland types (including some not found in the existing LSA) targeted for reclamation in the JEMA LSA and 13 (including some not found in the existing LSA) targeted for reclamation in the PRMA LSA. Therefore, the reclaimed landscape will be much less diverse than the existing landscape in both Project LSAs. This is mainly because nearly all wetland types cannot be reclaimed and there a large number of upland ecosites not being reclaimed. In JEMA, 6 out of 14 pre-disturbance upland ecosites are not being reclaimed (Table 14) and in PRMA, 19 out of 28 pre-disturbance upland ecosites are not being reclaimed (. If Shell is committed to "*maintaining the area's biodiversity*," then the diversity of upland ecosites should be increased. **Will Shell include a more diverse array of upland ecosites as targets for the reclamation landscape such that the diversity of ecosite/wetland types is more representative of the pre-disturbance landscape?**

4) **Issue:** Target of Achieving Equivalent Land Capability
Reference: Volume 5, Appendices 5-1 and 5-2, Section 2.4.8
Concern: "*The reclamation target is for equivalent land capability in the reclaimed area*." Even though it appears that specific targets for the closure landscape are provided in terms of ecosite/wetland types (Terrestrial Impact Summary, Sec 2.3, App 5-1 & 5-2), the somewhat vague target of achieving equivalent land capability (as per the Alberta Conservation and Reclamation Regulation) is repeated throughout the EIA. Using equivalent land capability as a target of reclamation is problematic for a number of reasons. In short, the central problem is that the Regulation requires that only a few plant species are planted during initial reclamation because it is believed that a succession of native plant species will invade the reclaimed sites over time. More specifically, the Regulation states that "equivalent land capability" means that the ability of the land to support various land uses after C&R is similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical. For reclaimed sites that were previously forested and/or are surrounded by forest the expectation is to grow both trees and understorey species that are consistent with the surrounding land. For example, if the development site was historically a boreal forest (and surrounding area is a boreal forest), then following reclamation the site must again be *capable of* supporting a boreal forest. That is, a boreal forest does not have to be present on site for reclamation certification to be granted, but it must be shown that the *capability* has not been diminished. Capability is assessed by comparing soil properties, hydrology, etc. with the surrounding lands; if these properties are consistent with surrounding lands, then capability is *assumed* to be restored on site. The vegetation component of the criteria is intended to give some assurance that the site is on the right vegetation trajectory. In other words, as long as some boreal species are present on site initially, it is *believed* that a succession of plant species will invade the site over time, resulting in a boreal forest with a higher diversity of species on the site at some point in the future. Believing that a succession of species will invade the site over time means that only a

small number of species will be planted during the initial reclamation of ecosite/wetlands. Unfortunately, evidence shows that a succession of species do not invade these sites over time and therefore following this approach means that reclaimed sites will bear little resemblance to pre-development sites (e.g., see Appendix F in OSVRC 1998). **Will the Proponent be more specific in terms of what is meant in reference to achieving equivalent land capability for these projects? Will a larger number of plant species be planted in each reclamation site during the initial stages of reclamation to ensure that the diversity and composition within reclaimed ecosites and wetlands is similar to that of pre-development ecosites and wetlands?**

5) **Issue:** Re-vegetation of Reclamation Sites to Establish Target Ecosites
Reference: Volume 5, Appendices 5-1 and 5-2, Section 2.5.2
Concern: *"While planting prescriptions for specific target ecosite phases will be used on various landscapes, natural processes will ultimately determine the natural progression and eventual vegetation community on the reclaimed landscape. Revegetation will be augmented by natural succession thereby providing a framework for these revegetated areas to evolve into ecosystems similar to those found in the region."*

As mentioned above, the approach for creating reclamation sites with a diversity of plant species similar to pre-development ecosites and wetland types is largely based on the belief that a succession of plant species will invade reclaimed sites over time. This belief is not supported by direct evidence in either the scientific literature or data from other oil sands developments (see Appendix F in OSVRC 1998). The plant species present within each ecosite/wetland type is determined primarily by the soil moisture and nutrient regime of a site (e.g., Bridge and Johnson 2000) and by the availability of seeds or viable asexual stems/roots in the first few years after fire. Under natural conditions in the boreal forest, plant species establish within the first few years after forest fire, with most establishing where the litter and fermentation (and sometimes humus) layers have been consumed by fire (e.g., Charron and Greene 2002). This is because conditions for establishment and growth are ideal: there is adequate moisture, space, and light, which allows plants to thrive. As these sites age, species richness decreases (Chipman and Johnson 2002). In a reclaimed landscape surface organic material is replaced back onto a site and tree species and shrubs are planted. The presence of a relatively thick surface organic soil precludes many sexually reproducing species from establishing. Therefore, these sites will largely consist of planted species that survive and species that can sprout from underground stems/roots and spread from adjacent intact forests into reclaimed areas. Evidence for the above argument can be seen in peer-reviewed publications (see examples above). In addition, it can be found in the Guidelines to Reclaim Forest Vegetation in Alberta (Appendix F in OSVRC 1998), which provides the basis for vegetation reclamation in this EIA. Interestingly, the guidelines' recommendations to plant a few woody plant species and allow successional processes to provide the remaining species contradict the data that the guidelines are

based on. For example, on the oldest reclaimed sites, grass and legume cover ranges from 50-100%. These vegetation communities have persisted for over 20 years and have resisted the establishment of native species either through natural invasion or planting programs. Furthermore, comparisons between reclaimed sites and natural stands show that there is very little similarity in terms of species composition between any of the reclaimed areas with natural stands (0.1 – 0.29). In most cases, the species that were common between the sites were the trees and shrubs planted as part of the reclamation program. These results demonstrate that it is incorrect to assume that "*revegetation will be augmented by natural succession*" and that "*revegetated areas will evolve into ecosystems similar to those found in the region*." Believing that successional processes will supplement any early reclamation efforts means that not enough species will be planted in the critical early period of reclamation to ensure that a variety of plant species will establish successfully. Any plant species that are required within a reclaimed site need to be planted or seeded in the first few years of reclamation. Within these reclaimed sites at least some patches of thin humus or exposed mineral soil will be needed to ensure early plant survival. **For each targeted ecosite/wetland type to be reclaimed, will the Proponent commit to planting or seeding a wider variety of species, with high similarity to that found in native ecosites/wetlands?**

6) **Issue:** Re-vegetation of Reclamation Sites to Establish Target Ecosites
Reference: Appendix 5-2, Section 2.5.2, pg. 76 and Volume 1, Section 20, pg. 22
Concern: "*Direct placement of suitable material to reclamation areas enhances site re-vegetation as dormant, in situ, native seed and viable root fragments are transferred with the soil amendment. Spreading the material on a reclamation area in early spring can result in the emergence of a variety of native forbs, wildflowers, grasses, and woody stemmed species over the late spring and summer. Direct placement will be implemented wherever practical.*" The belief that many native forbs, wildflowers, grasses, and woody stemmed species will emerge from direct placement of topsoil (i.e., LFH) in reclamation sites does not seem to be supported by evidence from reclamation of other oil sands project. For example, data from Suncor and Syncrude (see Appendix F in OSVRC 1998) shows that the most recently reclaimed sites (i.e., most recent reclamation techniques) have "*typically become dominated by a variety of herbaceous species that provide close to 100% total cover within a few years after reclamation… and maintain this control in the following years*." However, none of these herbaceous species were present in pre-disturbance stands. Given that none of the herbaceous species that dominated reclaimed sites were present in natural stands it does not appear that they would have emerged from the LFH and "*Trembling aspen, balsam poplar, a variety of willows and other native shrubs invaded the sites within a few years of reclamation*." Therefore, from Syncrude and Suncor's data there does not seem to be evidence that plant species are emerging from the LFH. Clearly, any plant species that are required within a reclaimed site need to be planted or seeded in the first few years of reclamation. Within these reclaimed sites at least some patches of thin humus or exposed mineral soil will be needed to ensure early plant survival. **Can the Proponent provide direct evidence that plant species**

will emerge from the reclamation material (LFH) placed in reclaimed sites? If not, will this expectation be removed from the EIA and more species planted or seeded in early reclamation to ensure that a wide variety of species become established in each of the reclamation sites?

7) **Issue:** Predicted Ecosite/Wetland types in the Closure Landscape
Reference: Table 11 Appendix 5-1, Section 2.3.2.1, pg. 58; Table 14 Appendix 5-1, Section 2.3.2.2, pg. 61; Table 17 Appendix 5-1, Section 2.3.2.3, pg. 64; Table 7 (Appendix 5-2, Section 2.3.3, pg .56)
Concern: Predictions as to the amount of area in each ecosite/wetland type to be reclaimed for JP Mine Phase 1 are provided in Table 11, for JEMA in Table 14, JP Mine Phase 1+JEMA in Table 17 and for PRMA in Table 7. As discussed above, the predictions of successful reclamation of ecosites (including the diversity of species found in pre-disturbance ecosites) in the Project LSAs are largely based on the beliefs that most of the species to be found in reclamation sites will arrive through successional processes and by emerging from the LFS. Unfortunately, there is little direct evidence to support these beliefs. Unless the majority of species are planted or seeded during initial reclamation, these sites will bear little resemblance to the pre-disturbance ecosite/wetland types. **Will a greater number of plant species be planted or seeded during initial reclamation to ensure that the species composition of each reclaimed ecosite is similar to pre-disturbance ecosites?**

3.5.2.5 Addressing Stakeholder Concerns

Traditional plant richness was assessed as a community level KIR and traditional plants themselves were assessed as a plant species level KIR for the vegetation, wetlands, and forest resources (Vol 5, Sec 7.3.1, pg 7-26). Direct losses of areas of high, moderate, and low traditional use plant potential as a result of the Project were assessed for the JEMA and PRMA LSAs and RSA. In addition, direct losses of Lichen – Jack pine communities (important critical habitat for woodland caribou) as a result of the Project were assessed for the LSAs. However, as noted above some areas of the JEMA LSA and RSA were misclassified as burn instead of being classified as to their ecosite/wetland type. These burn areas should be reclassified as to their ecosite/wetland types, then the areas within low, moderate, and high traditional plant use need to be recalculated, and the effects of the Project on these areas reassessed.

Areas of high, moderate, and low traditional plant potential were only included in mitigation and reclamation planning indirectly, through reclamation planning of some native ecosites and wetland types. Unfortunately, only a small number of species will be planted in each of the few ecosite types that are planned for the reclamation landscape. The Proponent purports that many plant species will establish into reclaimed areas over time through successional processes and by emerging from the LFH, which is an unsupported assumption. Long-term reclamation efforts in other oil sands developments (OSVRC 1998) has shown that this invasion does not occur and the plant species that are planted during initial

reclamation are virtually the only species (with the exception of some non-native weedy species) that dominated the reclaimed sites many years after initial reclamation. Therefore, under the current mitigation and reclamation planning for these Projects, relatively few of the plant species that the FNs have relied on up to now will be present after development of these Projects.

Specific Concerns and Requests

1) **Issue:** The Effects of Dust on Traditional Use Plants
   Reference: TES, Section 3.5.1.8, pg. 3-111
   Concern: The effects of dust on traditional use plants were not assessed specifically, although the effects of dust on Lichen – jack pine communities were assessed. It would be useful to provide a table showing ecosite/wetland types, their traditional use plant potential rankings, and the amount of area in each that might be affected by dust from the Project. The creation of dust may have a significant effect on traditional use plants, particularly because the areas of highest use likely occur next to roads, i.e., areas that are accessible and the primary source of dust. **Will the effects of dust be assessed specifically for traditional use plants, with tables for each LSA and the RSA showing pre-disturbance ecosite/wetland types, their traditional use plant potential rankings, and the amount of area in each that might be affected by dust from the Projects?**

3.6 Regulatory Setting & Cumulative Effects

Key Findings: Shell provides no rationale for the unprecedented combining of two entirely disjointed projects under one application. The short time between the finalization of the ToR and the submission of the current application raises doubt that the opportunity actually existed to accommodate Mikisew Cree comments. No consideration of pre-disturbance conditions (pre-1965) is apparent. Shell provides a series of conceptual reclamation scenarios, but without demonstrating past successes of these scenarios there is no solid foundation to predict future success.

3.6.1 General Comments:

The following comments are related to the regulatory setting in the Alberta Oil Sands Region as of May-June 2009 in conjunction with the JEMA and PRMA applications. Although many questions and comments are directed towards the JEMA (Volume 1), many of the comments provided and questions posed could also be asked of the PRMA application (Volume 2).

MSES understands that Shell, like other proponents of oil sands development, proceed with assessments of potential environmental impacts as dictated by GoA regulations. Regardless, the Mikisew Cree have

made past requests of companies (including Shell) and regulators to be proactive in their environmental assessment work, to be less conceptual and more concrete with respect to C&R planning, to work towards specific end land use targets for vegetation communities and wildlife, and not limit approaches because of narrow regulatory requirements, logistical constraints, perceived impacts, or financial costs.

3.6.2 Project Application

A single EIA report has been submitted by Shell in support of two applications, the JEMA and PRMA (referred to as the Project throughout the EIA). There are separate application numbers for each: Jackpine Mine Expansion – ERCB Application No. 1554396, AENV Application No. 005-00153125, 006-00153125 and Application File No. 00186157 to AENV; Pierre River - Application No. 1554396 to the ERCB, Application No. 001-00245358 to AENV and Application File No. 00245489 to AENV). In the Alberta Oil Sands Region this is an apparent first, where a single EIA report has been prepared for two "projects" on discontiguous leases held by Shell. Furthermore, the JEMA and PRMA are on opposite sides of the Athabasca River, with PRMA abutting and straddling the Athabasca River and, in contrast, the JEMA is some distance from the Athabasca River (see Volume 1, Figure 1-1). Other than to save costs and time, it is not clear why or how these two essentially separate projects (for in theory, one application could be refused, while the other is approved) can be considered in a single EIA report. No rationale is apparent throughout the introduction to the application materials (Volume 1) for a single EIA report.

As outlined in Volume 1 of the EIA application, Shell is specifically applying to:

- *The Alberta Energy and Utilities Board [now the ERCB], pursuant to the Energy Resources Conservation Act (ERCA) and Section 13 of the Oil Sands Conservation Act (OSCA), to amend the Jackpine Mine – Phase 1 Approval No. 9756 for approval to access additional mining areas on Oil Sand Leases 7277080T13 (Lease 13), 728101AT36 (Lease AT36), 7288080T88 (Lease 88), 7288080T89 (lease 89), 7405120015 9 Lease 015) and 7405090631 (lease 631), and to modify and add processing units to the Jackpine Mine - Phase 1 oil sands processing capabilities of these modifications and additions will increase the average normal capacity of the facilities by 5.8 million m^3/a (36.5 million bbl/yr), or 15,900m^3/d(100,000 bbl/d) of dry bitumen, for a total average normal capacity of the expanded facilities of 17.4 million m^3/a (109.5 million bbl/yr), or 47,000 m^3/d (300,000 bbl/d) of equivalent dry bitumen.*
- *The Alberta Energy and Utilities Board, pursuant to the ERCA and Section 13 of the OSCA, for approval to construct and operate an oil sands mine and bitumen extraction plant and associated facilities on Oil Sands Leases 740012009 (Lease 9) and 74001100017 (lease 17), to be known as the Pierre River Mine, located about 90 km north of Fort McMurray, Alberta and to the west of the Athabasca River. The expected production rate from the project area is 11.6 m^3/a (73 million bbl/yr) or 31,800 m^3/d (200,000 bbl/d) of equivalent dry bitumen.*

- *The Alberta Energy and Utilities Board to receive third party oil sands material (mined ore or intermediate process streams, such as bitumen froth) at the Jackpine Mine Expansion and Pierre River Mine facilities for processing.*
- *The Alberta Energy and Utilities Board, to produce and ship oil sands material (mined ore or intermediate process streams, such as bitumen froth) at the Jackpine Mine Expansion and Pierre River Mine facilities for processing at third-party facilities.*
- *Alberta Environment, pursuant to sections 67 and 70 of the Environmental Protection and Enhancement Act (EPEA) for an amendment and renewal of the Jackpine Mine-Phase 1 10-year operating approval (No. 153125-00-00 as amended), for the Jackpine Mine Expansion.*
- *Alberta Environment, pursuant to Sections 49, 50, 51, 54 and 59 of the Water Act, for an amendment and renewal of an existing licence to divert water for use at the Jackpine Mine Phase 1 project and a new licence to divert additional quantities of water from the Athabasca River and other surface and groundwater sources for the Jackpine Mine Expansion, as set out in the application documents.*
- *Alberta Environment for approval, pursuant to Section 66 of the EPEA to develop the Pierre River Mine in accordance with the environmental plans and specific applications described in this submission.*
- *Alberta Environment, pursuant to Sections 49, 50 and 51 of the Water Act, for a licence to divert water from the Athabasca River and other surface and groundwater sources for the Pierre River Mine, as set out in the application documents.*

In summary, Shell's plans include expanding resource exploitation by three times what is proposed under the current Jackpine Mine (Phase 1). The JEMA (up to 300,000 bbl/day) combined with the PRMA (predicted 200,000 bbl/day) totals half a million bbl/day. This would most likely be the largest current combined bitumen production facilities and operations in the Athabasca Oil Sands Region with comparable environmental impacts. **What is the rationale for a single EIA report in the context of the JEMA and PRMA?**

Shell wants permission to have the option to both ship oil sands material from their operations for processing at third-party facilities (presumably to offsite locations) and to ship materials to their operations for processing from third-party facilities (presumably from offsite locations). **Will additional off-site infrastructure and facilities be required for the shipping of ore and bitumen froth? Please explain and indicate where these were considered in the EIA report.**

Shell is requesting additional amendments and renewal of the Jackpine Mine Phase 1 10-year operating approval for the JEMA. **How will the Mikisew Cree be meaningfully involved by Shell in any process that alters or changes existing approvals?**

Shell states that it *"...is committed to cooperating with stakeholders and other developers in the region to promote orderly and efficient development of the Athabasca oil sands resource in an economic and environmentally acceptable manner."* (Volume 1, Cover Letter, Page 4) and that the Jackpine Mine Expansion is needed to allow for the continued development of oil sands resources in an *"...environmentally acceptable manner."*(Volume 1, Page 1-9). Details regarding how continued, expanded, resource exploitation will be carried out in an "*environmentally acceptable manner*" are not apparent. **Please elaborate and explain.**

3.6.3 Environmental Assessment & First Nation Concerns

3.6.3.1 Environmental Impact Assessment Process & Predictions

An EIA specific to the JEMA and PRMA was completed as per the approved ToR from AENV. Although the Mikisew Cree were presented with the opportunity to comment on the proposed ToR, almost none of their comments and requests were given meaningful consideration in the final ToR. Furthermore, given the relatively short lag time between the finalization of the ToR and the submission of the current application, there is strong reason to doubt that the opportunity actually existed for Shell and AENV to accommodate any requests made by the Mikisew Cree.

Shell has concluded *"...that there would be no unacceptable environmental or socio-economic effects from the projects, provided that the proposed mitigation and monitoring are undertaken."* (Volume 1, Executive Summary, Page I and Page iii). Such a conclusion is questionable because the footprint alone, compounded by fragmentation effects and zones of influence, removes land from traditional land use and the success of re-establishing traditional land use has not been demonstrated to date. Moreover, this conclusion cannot be made in absence of knowing what exactly the traditional land use is. Aboriginal groups have voiced serious concerns surrounding the "acceptability" of environmental impacts of oil sands developments and the lack of tangible progress with respect to reclamation, revegetation, and wildlife recolonization of disturbed areas (mitigation). **Please define the meaning of "*acceptable environmental and social effects*" as it relates to the Treaty Rights of the Mikisew Cree.**

As Shell has indicated, the plan for development of its lease holdings in the Fort McMurray area has been to stage the overall development through a series of expansions. Although this makes sense from an economic perspective, it remains an enigma as to how repeated changes or amendments to approved projects influences EIA predictions, monitoring programs, and mitigation such as reclamation planning. It is not apparent that Shell has provided information related to changes in environmental impact predictions for the Jackpine Mine Project – Phase 1 and the JEMA. Understanding these changes would alleviate some of the uncertainty surrounding impacts to Traditional Resource Use. Further, it appears that the PRMA will require additional regulatory submissions as resource delineation is still underway.

Please explain how previous commitments to monitoring, follow-up, and reclamation are impacted by the current application. For how long will the environmental impact predictions associated with the PRMA be valid?

For the JEMA, Shell essentially wants to develop what amounts to bitumen-fired cogeneration (Volume 1, Section 1.2, Page 1-13) to reduce dependency on natural gas. **What feedback has Shell received from First Nations and the Government of Alberta regarding such an operation? Is Shell aware of other operators being denied the ability to use bitumen to fire steam generators? Please discuss how the burning of bitumen will result in the need for additional contaminant removal and subsequent storage or disposal.**

As part of the JEMA, Shell wants to develop a second external tailings disposal area (the North ETDA) to provide external tailings storage and to optimize the approach to the first integrated in-pit tailings cell (Volume 1, Section 1-2, Page 1-14). ERCB Directive 074 – *Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes* was finalized on 3 February 2009. Shell's regulatory submission was in December 2007. Shell has not apparently reviewed their tailings management plan (Volume 1, Section 7.1, Page 7-1 and Section 7.2, Page 7-9) for alignment with the draft of Directive 074 which was available on 26 June 2008. **What changes have been made to the tailings plan to comply with all aspects of Directive 074?**

3.6.3.2 Pre-disturbance Conditions

For the JEMA and PRMA, the EIA evaluated three scenarios:

- the Base Case, which includes existing environmental conditions as well as existing and approved projects or activities within the project area. The cumulative effects assessment included existing and approved activities;
- the Application Case, which includes the Base Case plus the Project; and
- The Planned Development Case, which includes the Application Case and other planned projects (Volume 1, Section 17.1, page 17-1).

No consideration of pre-disturbance conditions (pre-oil sands exploration and development) is apparent. Although comparing current (baseline) conditions to post-project scenarios has some merit, the Mikisew Cree have already noticed a wide-range of environmental impacts resulting from industrial development activities such as exploration. Other development proponents (i.e., Total) have begun to examine pre-disturbance conditions.

How will Shell consider actual pre-disturbance conditions (not current or baseline conditions) in its reclamation planning efforts?

3.6.3.3 Conservation & Reclamation

Although Shell has provided a conceptual C&R Plan for the first 10-year period as necessary under existing regulatory requirements (Volume 1, Section 20.1), it is not apparent that they have not gone beyond the minimal requirements of the ToR as approved by AENV. Shell also notes that they used previous approval conditions for the Muskeg River Mine Expansion and Jackpine Mine – Phase 1 to guide the current C&R Plan (Volume 1, Section 20.1, Page 20-1). **What specific learnings exist from the Muskeg River Expansion and Jackpine Mine – Phase 1 that have been incorporated into current C&R Planning? Please elaborate and explain.**

Although Shell provides a series of conceptual mining and reclamation scenarios from 2010-2049 (JEMA) and 2010-2039 (PRMA), no estimates surrounding the likelihood or probability of success associated with these scenarios is provided (Volume 1, Figures 20-4 to 20-14 and Volume 2, Figures 20-4 to 20-14). Without any such assessment, the scenarios provided by Shell amount to best-case wishful thinking with no specific back-up or "adaptive management" in place should reclamation be unsuccessful. Specific details surrounding methods for reclaiming vegetation communities such as old-growth forests and wetlands are not apparent. **Please provide detailed C & R plan with targets and benchmarks and with strategies for monitoring progress. Such a plan should also contain alternative strategies should targets not be met. The plan should be based upon known successful C & R strategies and should include at minimum, lease-wide TR targets and associated temporal scenarios for reclamation, wildlife recolonization, revegetation, and wetland re-establishment The C & R plan should actively consider and utilize Mikisew Cree TEK.**

3.6.3.4 Regional Planning & Cumulative Effects

Although Shell provides an overview on regional management initiatives, including multi-stakeholder environmental committees such as CEMA and its working groups (Volume 1, Section 16.2, Page 16-7), the Mikisew Cree have withdrawn from CEMA because of bureaucratic foot-dragging and a lack of tangibles being produced that result in decreased environmental impacts or improved environmental management. In addition, the lack of local or regional targets for various environmental indicators and receptors such as wildlife, vegetation, and wetlands remains an outstanding issue of concern and continues to be an issue that neither development proponent nor regulator will address to the satisfaction of the Mikisew Cree. As such, there are very few tangibles from such regional planning initiatives (i.e., CEMA) that directly or indirectly address the deprivation of Treaty Rights in the Alberta Oil Sands Region. Shell's apparent reliance on regional initiatives and management systems to address cumulative effects (Volume 1, Section 17.1, Page 17-4) is ineffective in alleviating the vast amount of uncertainty that surrounds unproven reclamation and minimally-detailed regional planning efforts. **What**

steps will Shell take to develop, at minimum, lease-wide targets and associated temporal scenarios for reclamation, wildlife recolonization, revegetation, and wetland re-establishment?

It is not clear if lease mine planning coordination and boundary agreements and discussions with other development proponents for JEMA (Volume 1, Section 16.3) consider regional planning for vegetation communities, surface water flow, and wildlife movement and migration across lease boundaries. **Given the current lack of regulatory requirements for detailed planning (i.e., targets and associated temporal scenarios); it is not clear what is being done. Please elaborate and explain.**

A bridge is part of the PRMA application (Volume 2, Figure 20-1, Page 20-3). It is not apparent that cumulative effects to TLU from multiple crossings, water intakes, river encroachment by industrial activity, and increased recreational use of the Athabasca River and the Athabasca River Valley were considered and addressed in the EIA report. **Please elaborate and explain.**

It is apparent from the review of other disciplines contained within the EIA that cumulative effects are not adequately addressed and are similar to that of previous oil sand applications. There is some concern over the quality of data used and details regarding analyses are lacking. The data used for the CEA is largely from 2004 which could be considered out of date relative to the rate of the development in the area. A consequence of using outdated data sets is underestimating the amount of disturbance in that area. **Please provide a summary table that lists sources and dates of the last data updates. In the map references, IHS Energy Ltd. (August 2006) was listed as a data source. Please provide a description of the data set.** It is not clear whether the approved data include seismic lines. **If this is the case, why was a linear density analysis not conducted?** This analysis would help in interpreting the differences between mean and median patch size in the patch size analysis.

As indicated elsewhere throughout this report, a quantitative CEA is required so that the Mikisew Cree may gauge the amount of land being effectively removed from the limited pool that remains for them to practice their Treaty Rights. **Can Shell provide a CEA which focuses on the impacts of the projects on Traditional Land Use?**

4.0 Recommendations, Requests & Questions

In the following, we present a list of recommendations, requests and questions for each discipline. Although the recommendations below highlight the overarching issues, they do not replace comments and questions raised throughout the report and they are not necessarily mutually exclusive. The Mikisew Cree may wish to engage the discipline experts retained by either party in a technical dialogue to discuss the specifics of the main body of the reviews above.

Public Consultation, TEK, and Community-Based Monitoring

1) Please provide exact details of various discussions and meetings held with local communities and how the resolution of the concerns and issues was incorporated into project development, impact mitigation, and proposed monitoring.

2) Please provide information on future plans to maintain the community consultation process following completion of the EIA review to ensure that the TR holders will have an appropriate forum for expressing their views on the ongoing development, operation, and reclamation of the Project. We recommend that the Mikisew Cree propose suitable CBM of various project-related activities on the land. Communities could offer TEK to Shell as well as solidify a strong partnership in sustainably managing and assessing the TR on the land.

3) It is important to know whether aboriginal populations were given the opportunity to participate in the planning or design stages and in establishing the biodiversity indicators and assessments for this application. Please provide these details.

4) The assessment of TR was not done specifically for the local area. How does this accurately convey TR in the local communities and the extent of their TR if Shell has not assessed this locally?

5) We recommend that the Mikisew Cree request that a complete assessment of TLU, including the Mikisew Cree and other FNs, be conducted by Shell.

6) How can Shell assess the impacts of the Project on TR accurately if there are gaps in the information?

7) The Proponent has committed to continuing the dialogue with the aboriginal populations to learn their viewpoints at suitable times. However, at the EIA stage, the Proponent and stakeholders should have discussed issues so that they can be duly incorporated within the EIA. Why weren't these discussions completed prior to Shell applying to the regulatory authorities?

8) Can Shell provide examples of successful reclamation in terms of traditional resource use? If not, how can the Mikisew Cree be assured that reclamation will be successful, especially when there are gaps in the understanding of the TLU in the local area? We recommend that the Mikisew Cree request a detailed assessment about future developments on the land so that they can make appropriate decisions for future partnerships with industry.

9) More details are needed so that a gap analysis may be performed and future courses of action can be clearly demonstrated.

10) Please provide some details as to what the compensation measures might entail? To pass on TEK to future generations, FNs require the TR and land to showcase their cultural traditions. How will Shell ensure FN needs to maintain their Treaty Rights?

Traditional Land Use and Socio-economics

The following recommendations have been summarized from the Twin River Consulting Report (see Appendix A of this review) to address information gaps:

1) If these projects are approved without addressing the likely impacts on the Mikisew Cree and other FNs, in light of their Treaty Rights and what is needed for the meaningful exercise of those rights, it will limit FN input into mitigation, compensation, and Project design. How can these effects be minimized if a proper assessment has not been made to measure the Project impacts?

2) Given the current state of this Application, a separate consultation process should be established, including setting out how any results from that process would be integrated into the regulatory review and decision-making process.

3) What are the implications of this project for the continued and future traditional land use of the FN? We note, in particular, that the Application does not consider the impacts of the "taking up" of lands (either through direct footprints or zones of disturbance or through fragmentation) within the Traditional Territory of the Mikisew Cree and how this will impact the Mikisew's ability to exercise their Treaty Rights. Without understanding the impacts of the grants of tenure, and developments of various kinds on those lands, and what is required for the Mikisew to meaningfully exercise their rights in the future, it is difficult to understand the direct, indirect, and cumulative impacts of the Application on the Mikisew Cree's rights.

4) What will be the Project impacts on other areas of fishing activity and the community food supply?

5) Has the Applicant studied the cultural TLU of the FNs enough to be able to model and assess the impacts of the project on TLU tipping points?

6) In order for a proper impact assessment to be undertaken, we recommend that a full consultation process be completed. Useful conclusions cannot be made based on the methods contained in the current application.

7) Why is there no mention of any participation in reclamation consultation with the Mikisew Cree?

8) We recommend that the GoA and Industry work together with the FN to acquire and develop lands in the Fort McMurray region to allow the FN to construct and make appropriate housing available for the Mikisew members. Industry should work with the FN to build appropriate aboriginal housing in satellite communities on a joint venture basis with the FN.

9) We recommend that a full socio-economic study be conducted in association with a proper consultation process to identify the problems and causes of educational shortfalls. This will allow a thorough and coordinated mitigation plan to be developed.

10) We recommend that a full consultation process be initiated to assist all parties in identifying mitigation measures that directly address the socio-economic problems of the area, including information from a FNs perspective.

11) Given the higher rates of cancer and other problems reported in one of the rural communities, how will providing better care for Shell employees assist in reducing the ongoing impacts on rural health services in the area? Mitigation proposals should directly address the issue of attracting and keeping qualified staff at rural medical centers.

12) Are the rural communities adequately serviced in the emergency, health, and education fields?

13) Please include a proper study of the transportation rights in the consultation process.

14) Please provide a discussion of the socio-economic setting which would allow mitigation proposals to be made and carried out in a meaningful fashion. The causes of income disparity should be studied and the role of this Project and others should be discussed in that study context.

15) The analysis of the effects of development on family structure and income, especially in the rural areas, should be undertaken.

16) We recommend that an analysis be conducted of the implications of water on each of the socio-economic issues outlined in the review. These issues do not appear to be discussed in the EIA or the Socio-economic Impact Assessment.

17) How do these initiatives impact the members of the Mikisew Cree?

18) Do any of these projects and initiatives address the impacts on the Mikisew Cree?

19) What are the total expenditures on these initiatives and what percentage of these expenditures will assist the Mikisew Cree?

20) How does the major capacity and infrastructure Projects address the Mikisew Cree concerns?

21) How do Shell's mitigation proposals assist the Mikisew Cree in dealing with the impacts of the projects?

22) We recommend that the Proponent conduct a proper study of regional cumulative impacts rather than a narrow, project-specific effects assessment.

23) Although access to traditional hunting, trapping, fishing, and gathering areas is an important consideration, what is missing entirely from the EIA is an analysis of what is needed to sustain those rights today and into the future. We recommend that Shell provide this analysis.

Wildlife

1) Will recovery through progressive reclamation happen rapidly enough to avoid ecosystem shifts?

2) The Mikisew Cree should request that ecosystem shifts be included as indicators for monitoring and triggers for adaptive management.

3) Clarification is required to provide the Mikisew Cree with an understanding of what the baseline data represent and what the baseline data will be used for in the future.

4) No "end of closure" dates are provided. This information would shed light on the potential for TLU by the Mikisew Cree, such as wildlife harvesting, if wildlife recolonization of disturbed areas is successful. Can such information be provided?

5) Can this information be provided so that it may be communicated to the Mikisew Cree community members? If not, why not?

6) If areas are disturbed or construction is carried out and operations commence at a faster rate than presented, why wouldn't this affect EIA predictions for wildlife and wildlife habitat? Wouldn't disturbance be more intense in the sense that the construction and operation schedule is compacted? How would the reclamation of disturbed areas, and subsequent wildlife recolonization, be impacted?

7) Upland birds and waterfowl were not included as KIRs. Please elaborate and explain.

8) Please explain why wildlife mortality does not appear to have been addressed as a "Key Question".

9) How will the RSF results and HSI maps be used in Project planning and wildlife conservation? Will important wildlife areas be avoided? How well do HSIs agree with survey data? In addition, what are the recognised limitations of the RSF data and the possibility of false negatives? What degree of confidence does Shell have for these results given unproven reclamation and unclear regional development scenarios? How does wildlife monitoring data collected from the Muskeg River Mine and Jackpine Mine – Phase 1 compare to RSF and HSI predictions?

10) What is the range of accuracy associated with the AVI data used in the various LSA Models?

11) Does this mean that RSA-level models are inherently more inaccurate than the LSA models?

12) Can Shell explain why habitat fragmentation analyses were not conducted for the remaining wildlife KIRs?

13) What do the combined results of HS and RSF modelling, Habitat Fragmentation Analyses, and Linkage Zone Analysis mean for each wildlife KIR at the LSA and RSA levels?

14) Rationale behind some aspects of the rating system remain unclear. In addition, it is not clear how, or if, these impact assessment criteria will be evaluated through future monitoring programs. Please explain.

15) Please provide site-specific mitigation measures.

16) How were future increased levels of noise in these corridors considered in the relative effectiveness of these areas to act as wildlife movement corridors (see Figures 4.6-1 to 4.6-4 in Volume 3)?

17) There is no apparent consideration of re-establishing wildlife distribution and abundance to pre-disturbance (pre-development) conditions. Why not?

18) Have various corridor options (widths and lengths) been considered for wildlife movement or will the corridor design simply be a function of minimizing resource sterilization? Can preliminary corridor design criteria be provided?

19) Are the results of current monitoring programs for the Jackpine Mine – Phase 1 and Muskeg River Mine being compared to EIA baseline conditions? To pre-disturbance conditions?

20) Have the Mikisew Cree been meaningfully consulted regarding this proposed monitoring of corridor effectiveness?

21) Please provide additional wildlife passage information in the context of the proposed Athabasca River Bridge.

22) Shell has indicated that the effects on yellow rail habitat will be high in magnitude, resulting in a high environmental consequence for yellow rail at the LSA level. How is this outcome considered acceptable? What feedback has Shell received from Environment Canada and ASRD regarding this potential impact?

23) Can Environment Canada or ASRD provide advice on how monitoring and follow-up programs can be designed to evaluate the impact predictions and protect any potential yellow rail populations (or local aggregations) from the effects of the Project? Is there a guideline for any given percentage of the potential habitat that would need to be surveyed in order to assure that the chance of affecting locally aggregated populations of SARA-listed species is minimal?

24) What specific issues were identified by the Mikisew Cree during the development of the current regulatory submission?

Vegetation

1) Please justify how the use of stand attribute calculations provides a meaningful description of the pre-disturbance landscape.

2) Please explain why detailed vegetation plots for verifying ecosite/wetland types were not conducted in some ecosite/wetlands types or in cutblocks and other disturbances in either the JEMA or PRMA LSA.

3) Please include the detailed information on basic statistics in order to facilitate the monitoring of change over time. This information is also necessary to assess the accuracy for the land cover classification in the RSA.

4) Coniferous jack pine in the RSA and ecosite phases a1 (lichen jack pine, Central Mixedwood; bearberry jack pine, Athabasca Plain) in the LSAs should be ranked high for traditional plant potential.

5) To determine change over time when modeling cumulative effects, please consider quantifying landscapes at several points of time, including the pre-oil sands development period.

6) Were searches of non-native and native invasive species in the LSA and RSA exhaustive? If not, what are the limitations of these data?

7) Areas classified as "burn" throughout most of the EIA were actually sampled and classified as to their ecosite or wetland type in only one part of the EIA. Please explain why these detailed data in recently burned areas were not used in the baseline data for the assessment of Project effects on native ecosite/wetlands, traditional use plants, rare plants, biodiversity, and forest resources.

8) Will areas classified as "burn" in the baseline data be reclassified according to their actual ecosite or wetland types to reflect the fact that burned areas are simply young forests? Will project effects on losses of native ecosite/wetland types, areas of traditional plant potential, rare plants, biodiversity, forest resources, etc., be re-assessed based on these reclassifications?

9) Will the burned areas be re-classified as to their ecosite/wetland type and then the areas within low, moderate, and high potential for traditional use plants in the JEMA LSA and RSA recalculated?

10) Although an important component of these assessments, the methods of data collection and analysis contributing to the updated land cover classification are not given in enough detail to evaluate their rigour. Please provide this information.

11) Why was no accuracy assessments of AVI conducted using vegetation plot data? In addition, please explain the amount of adjustment necessary following the conversion of AVI to ecosite phases.

12) Please clarify how the new imagery was integrated with the old classification, or, if an entirely new classification was conducted with the new satellite imagery, please explain how this was done. Although stated generally, how and how often were plot data used to adjust the regional map for local conditions (Section 3.3.2.2, pg. 3-26)? We recommend using ground information to develop training sites and accuracy assessments for satellite image classification. In addition, more detail (such as software parameters, algorithm, training sites, etc.) on the classification methods should be provided so that the method can be assessed and repeated in the future. Please provide an accuracy assessment of the regional land classification.

13) Besides the mean, provide descriptive statistics on the average percent cover by vegetation type. Ecosite phases in the LSAs were originally modeled from AVI data. Please give an assessment of how many adjustments were necessary to the modeled output. In other words, how accurate are the AVI unadjusted modeled ecosites phases?

14) Specifics are lacking regarding how the LSA was stratified by habitat for rare plant surveys. Please provide this information.

15) Provide details of how the LSAs were stratified for the rare plant surveys. Please provide the frequency data of rare plant occurrence for vegetation types and natural break values for evaluation.

16) Will any additional detailed vegetation samples be taken to include all ecosite/wetland types and disturbances in the JEMA and PRMA LSAs? For samples taken from outside the LSA, will more information be provided, such as what site information was collected in these samples and the locations of samples in relation to the LSAs?

17) Please verify riparian habitat characteristics within the 100 m buffer of watercourses that defines the riparian category in the LSAs. How much does this buffer distance over or under estimate riparian habitat?

18) Why was old growth attributes of stands within the LSAs not verified in the field or derived from vegetation plot data? Please verify with field or AVI data that old growth characteristics (snags, downed logs, canopy gaps, etc.) are correlated with areas modeled as old growth forest.

19) Please identify areas in the RSA and LSA that are particularly important for traditional plant harvest by season.

20) We recommend that the Proponent identifies specific areas in the LSA and RSA that are of particular importance for TR.

Biodiversity

1) Include baseline measures of genetic diversity on plant species within the LSA. Woody plants are likely to be more diverse and have larger population sizes than herbaceous plants, particularly annual or selfing taxa. Select representative species with different modes of reproduction. Genetic diversity measures could include allozymes or DNA markers (RAPD, AFLP, ISSR) (Nybom 2004) and follow guidelines suggested by ASRD (2009).

2) Provide the relative abundance of vegetation types used in the rare vegetation type index.

3) Would the Proponent consider using % total area?

4) No verifications of the landscape metric predictions were carried out in the field, such as testing whether there is a correlation between metric calculations and species richness. Why was no verification completed?

5) Please provide the raw or summarized data used in the plant rarity scoring.

6) Total species richness among vegetation types is based on LSA plot data and other vegetation surveys in the Oil Sands Region. This data does not appear to be provided, but rather is referenced

as being in Golder's vegetation databases (Section 2.2.3.1, pg. X-10). Please recommend that Shell provide the data.

7) When plot data was not available, species richness was estimated by inference from similar vegetation types, an assumption that may or may not be valid. Please discuss how these factors will impact the biodiversity assessment.

8) One problem with ranking poorly sampled wetlands based on similar wetlands, is that if you assume the wetlands are similar, you would need to assume that they have a relative high percentage overlap in species composition and would therefore, deserve a lower rank than 3. Please discuss.

9) Please address variation of seasonal use of core areas in the analysis.

10) The biodiversity potential is a poor measure to use for monitoring the complexities of biodiversity and should be avoided. Instead, please consider protocols such as developed for the Alberta Biodiversity Monitoring Program should be considered.

Hydrogeology

1) Why did the EIA not comply with the ToR and clearly identify Project impacts to hydrogeology, including major, negative, irreversible impacts such as dewatering and excavation of portions of the Kearl Channel aquifer?

2) Why were the peak impacts of degraded groundwater quality discharging to surface water systems in the LSAs not determined in the EIA?

3) Please discuss why more sampling was not conducted in fen areas.

4) Why was no solute transport modeling of regional groundwater flow carried out to assess cumulative effects of the Project on regional groundwater quality? What are the expected cumulative effects of the Project with respect to regional groundwater quality?

5) What was the data source for natural biodegradation rates used by the proponent in the PAH contaminant transport analysis? If the PAH natural biodegradation source data is laboratory-derived, what plans, if any, has the proponent to conduct field-based studies of natural biodegradation rates for PAH compounds?

6) Why was the contaminant transport model time scale not selected to include arrival of peak concentrations for all Project-related contaminants of concern at all model water quality assessment

nodes? What are the predicted peak concentrations of all Project contaminants at all water quality assessment nodes?

7) What are the predicted impacts to groundwater quality degradation within the Fort McKay Indian Reserve No. 174C because of the proposed development of the JEMA and existing, approved, and planned oil sands projects in the area?

8) Why is it considered acceptable to establish the temporal boundaries for the EIA within a time frame that will not realize the maximum predicted impacts to water quality degradation?

9) As the monitoring plan is a conceptual plan without details on the proposed number, depths, and locations of monitoring wells, what opportunity will the local FNs have to review and comment on the final plan if the project received approval?

Hydrology

1) Why is Shell not using dry stackable tailings as part of its commitment to BATEA?

2) If statistically significant trends are detected in certain flow conditions in the Athabasca River and other rivers and streams within the project area, we recommend that the Mikisew Cree require that they be incorporated into the estimation of future streamflows and the project effects and cumulative effects analyses.

3) The Mikisew Cree should request a mandatory commitment of existing, approved, and proposed oil sands projects to participate in collaborative water-related research projects to evaluate the cumulative effects of current, approved, and planned oil sands projects in northern Alberta. Research projects should include:

   - cumulative effects on groundwater with associated effects on local wetlands, lakes, streams, and rivers;
   - an oil spill dispersion analysis for the Athabasca River;
   - cumulative effects of oil spills and leakages on the Athabasca River and water bodies downstream of the Embarras; and
   - water balance analyses for each specific landscape unit with a unique land cover – soil – climate characteristic, with particular focus on reconstructed landscape units, so as to optimize conditions for successful reclamation.

4) We recommend that the Mikisew Cree request, in the name of public interest, that an oil spill dispersion study be carried out, in addition to dispersion modelling, by the Proponent, with the collaboration of other oil sands operators.

5) As the State of the Muskeg River Watershed Report (2008) includes data and analyses not included in the EIA, it is requested that the findings are integrated or amended into the EIA.

6) Please provide an explanation as to why the runoff produced by precipitation is twice as high in JEMA as in PRMA.

7) Please provide a scientific rationale and data sources for the reported mean annual precipitation value at PRMA.

8) Please provide a scientific explanation for the wide range of runoff depths reported. Please provide information on how the noticeable difference in watershed characteristics is reflected in the parameters for hydrological simulation.

9) Please provide the magnitude of the 100-year flood, as well as the 760-year (for PRMA) and 1034-year flood (for JEMA) for the watersheds under investigation.

10) As reported, the Kearl Lake water balance does not balance. Please provide the scientific rationale for the reported values.

11) Please provide information on the consequences of the reported positive trend in air temperature in terms of the hydrology during the life time of the project and future reclamation efforts at the end of the project. Please specify how the trend in air temperature will change the snow-to-rain ratio over the life time of the project, and also specify the anticipated associated effects on the streamflow regime in the project area.

12) Please provide the scientific rationale as to why the model is expected to realistically simulate the change in runoff behaviour because of very severe changes within a watershed, when obviously those changes do not result in changes to the output.

13) Please provide the scientific basis to transfer hydrological parameters from a calibrated watershed with certain physical-hydrological characteristics to a watershed that is distinctly different. On what scientific basis do the Proponents assume that reconstructed soils and reclaimed vegetation are identical to baseline watershed conditions? Based on current soil reclamation research undertaken since 1971, what are the typical soil water properties of different terrain units within reclaimed areas? What are the combined effects of a reconstructed landscape under climate change conditions in terms of providing sufficient plant available water?

14) Please provide the scientific rationale for the statement that the basal aquifer depressurization will not increase the deep percolation water loss from Kearl Lake.

15) Please provide the impacts of the increased watershed area on the Kearl Lake water balance.

16) Please provide the scientific method used or the source to define the PMF.

17) How long will it take for the pit lakes to be filled with sediments? Please quantify by how much channel erosion in the receiving streams will be increased because of reduced sediment load.

18) Are new sediment data available that were collected since 1991? If new data are available, please report them. If new data are available, please report if any adjustments have to be made to optimize the quality of the predictions.

19) Please provide flow parameters for characterizing changes and effects on the Athabasca streamflow because of the proposed projects for the peak flow and the 7Q10 low flow for at least the 100-year return period.

20) Were these trends integrated into the effects analyses, in particular, into the cumulative effects analysis?

21) In the interest of preparing for conservative future streamflow conditions in the Athabasca River, please base the hydrological effects analyses of the two projects on appropriate and conservative trend statistics, rather than on statistics from watersheds with very different physical and climatological characteristics. Alternatively, please provide scientific literature to support your argument that streamflow trends from two completely different watersheds are transferable.

22) Please provide information on the climate change scenarios reported:

- Which GCM was used?
- Which emission scenario is used?
- How were the streamflow values derived?
- Which variables were changed, and how?
- Was the entire Athabasca River watershed simulated?

23) As the HSPF model is reportedly insensitive to parameter changes, why is it assumed that climate change scenarios can be simulated?

24) Does the surface water quantity monitoring plan include soil moisture monitoring within the various reclaimed landscapes? Please provide the plans to monitor residual impacts on surface water quantity and soil moisture, including the monitoring design, sample sizes, statistical analyses, models, and assumptions.

Water Quality

1) Please discuss how the likelihood of reclamation success could be evaluated.

2) It would be preferable to see explicit inclusion of mechanistic relations among biological, chemical, and physical components affecting water quality.

3) Even if aeration occurs during outflow, please explain how water coming from under ice, where anoxia likely develops during winter, would be this oxygen rich.

4) Please clarify what is meant by "several layers of conservatism" (page 6-47) in the preliminary assessments. Please justify how conservative assumptions will be sure to place the results in a biologically meaningful parameter space.

5) How can it be stated that any further increase does not matter? It is inappropriate to assume infallibility of one component of the EIA so as to dismiss possible effects in another. Can assurance be provided that where linkages have been deemed invalid, the possibility for discovery of unexpected results that may result from non-linearities, for example, has not been precluded?,

6) Alternatively, if it becomes too onerous to conduct the basic research to understand specific processes in detail, would the Proponent consider an approach by Reckhow (1999) whereby probability network models are used to provide predictive capacity? Are there alternative analytic structures or models that can incorporate so-called outliers, particularly those attributable to process error?

7) Please provide more recent scientific research literature into the end pit lake discussion.

8) What assurance is there that viable biological processes will be established, and should these fail, what contingency measures could be implemented given that drainage areas will continue to drain and supply water to pit lakes and to natural waterbodies, all of which discharge ultimately to the Athabasca River? If an appropriate treatment can be provided when water quality is sub-standard, then why not apply it to all water and be assured of adequate quality? Can assurance be given that the complex interactions among biota and their environment characteristic of lakes will establish successfully?

9) How can this happen if potentially novel properties exist for the developments being evaluated here? Whereas it is possible during modelling of individual substances to sample repeatedly from the respective distributions established, can this be done meaningfully for toxicity? Could more detail be provided as to how modelling occurs for WET? Because WET synthesizes many possible effects and mechanisms, can more detail be provided as to how the dynamic and probabilistic modeling accounted for complex interactions?

10) Will the Proponent consider the addition of technologies such as semi-permeable membrane devices instream to provide longer-term integrated measures of water quality? Please provide assurance regarding what will happen should water quality deteriorate.

Fisheries

1) Is the decline in Arctic grayling between 1981 and 2004 an atypical 1 year event, or does this represent a gradual deterioration in conditions in the region over time?

2) Please explore other possible explanations of the decline in migrant fish populations in the Muskeg River because these changes may signal a gradual deterioration of fish abundance and aquatic habitat in the region overall.

3) Electrofishing details useful for future study replication are lacking (e.g., current used, electrofisher settings). Please provide this information.

4) Please discuss this discrepancy in the setting of minnow traps and provide a justification for the conclusions predicated on this data.

5) Please provide the rationale for sample size, frequency, and number of samples chosen because it is not clearly defined consistently. Without this information, how can stakeholders be assured that the Proponent has (or has not) complied with their mandate to restore aquatic resources as required by the Fisheries Act Authorization to be released for the Projects.

6) Please provide regional monitoring plans.

7) How can the Proponent purport that the Project will have negligible effects on surface water quality, and thus fish health/abundance, given the uncertainty in the effectiveness of the mitigation measures?

8) Are there examples of where these compensation measures have been effective? Given that the Proponent recognizes the uncertainties in their own prediction confidence, how will the Proponent ensure that the Mikisew Cree can continue to pursue traditional rights?

9) Please discuss whether reduced spring flow may change conclusions for northern pike.

10) Please justify how the fish abundance at these low levels would be adequate for comparisons with future monitoring programs?

11) How will the decline in migratory fishes impact the Mikisew Cree's Treaty Rights?

12) Please provide justification for the removal of lotic habitat with the replacement of lentic habitat.

13) How can the Proponent ensure that these mitigation measures will be effective?

14) To mitigate uncertainty associated with the compensation lakes to date, we recommend that a shallow lake free of MFT be constructed to replicate those standing water bodies that have been lost in the RSA (and will be lost within the LSA).

15) Will EPLs and polishing ponds support riparian buffers with native biotic indices typical of those found on upland ponds and lakes (e.g., Kearl Lake)? What will Shell do to encourage riparian buffers to grow around these ponds (and the compensation lake)?

16) AENV has yet to release their minimum flow requirements for key times of year in the lower Athabasca River. Why have these requirements not been released?

Aquatic Health

1) We recommend requesting an increase in sample size, which would strengthen the rigour of analyses performed on individual parameters. Tissue sampling and analysis are expensive to do; however, compromising sample size can put ecosystem health at risk for aquatic life and humans. At least 30 samples need to be collected of individual parameters to achieve statistical significance.

2) Why does the Proponent not consider these other non-lethal end-points that may also have profound effects on fish health?

3) At this point, limited scientific understanding of the indirect sub-lethal effects of these compounds, singly or in combination, may preclude the ability to assume that no effects of their presence in effluent waters on fishes would be expected. Please discuss.

4) What assurance can the Mikisew Cree receive that RAMP testing will be sufficiently rigorous to monitor fish population health and abundance over time?

5) Would the Proponent consider monitoring more rigorously for heavy metals?

6) At what point do small (i.e., negligible) effects on tainting and tissue metal burden following exposure to run off, which ultimately ends in the Athabasca River, become cumulatively detrimental to aquatic health? The proponent argues that their runoff will provide a clean bill of health and not lead to a bioaccumulation of metals and tainting in the lower river (i.e., Peace-Athabasca River); however, this is where sediment is appreciably finer and more likely to bind toxins and hydrocarbons in negligible concentrations. Did the Proponent consider this in their analysis?

7) We recommend that the Mikisew Cree question if perhaps regulators' guidelines are too weak in addressing longer term cumulative effects in aquatic ecosystem heath. We recommend that the Mikisew Cree request that the Proponent conduct bile analyses and measure and monitor for sub-lethal effects.

Air Quality

1) It is believed that further reductions in NO_x emissions can be made with the mine fleets, but are there any procedures or plans to validate these emissions?

2) It was not clear if road emissions were accounted for by roads / traffic, or simply added in as a background factor. Please clarify.

3) Does Shell have any plans to address the observed increases in SO_2, NO_2, H_2S, THC, and $PM_{2.5}$? Are there plans to investigate possible reduction measures to limit or stop the increasing trend? The trends for $PM_{2.5}$ appear to be more diverse. Are there any contingency plans in the event $PM_{2.5}$ levels begin showing more upward tendencies?

4) The Air Modelling Methods (pg 3-38) indicate that only two years of meteorological data are used for this assessment (1995 from BC/AENV, and 2002 from AENV), with local stations used to supplement localized effects. Why was this format chosen?

5) Has the use of ashphaltene as a fuel been tested and used elsewhere? Is there any direct emission testing that has been done? If so, what do the emissions look like?

6) Based on the summary of the Regional Community impacts, specifically at Cabins J, K, and L, which show elevated levels of several pollutants, have there been complaints or concerns directly from people that own or reside at these cabins?

7) Shell purports that "*Generally the Oil Sands Region experiences a relatively high background ozone concentration*". Can Shell validate this statement or provide the data to support it?

8) There is no mention of the Project adhering to or addressing GHG emissions. Why was this not addressed under this key question?

9) What is an acceptable risk to the population being exposed – if 100 odour complaints have been filed, is an additional 4 acceptable? On a percentage basis this is small (~1%), but for an individual living at these Cabins, will the additional 4 to 12 hours of odour actually be only 4 to 12 hours? What contingency is in place for these individual(s) to protect their way of life or ensure that odours will not be rampant for them? What is the true number of complaints to AENV, ERCB,

Municipality, WBEA, etc., on the odour issue? What additional mitigation procedures can be applied to help lower the potential for odour complaints, or address them when they come in? If a large number of complaints are registered, what is the Standard Operating Procedure to address them?

10) What plans are in place for "*developing technology to capture and store carbon dioxide (CO_2) emissions from industrial emission sources*"? With many applications being dropped from the Alberta Technology Fund, is CO_2 capture still being investigated by Shell? What specifically will be done for these projects, given that the maximum projected operating GHG totals is 5457 kt of CO_2e per year (includes both JEMA and PRMA). Why would Shell consider a dirty technology (ashphaltene-fired cogeneration) that would put out an additional 2024 kt of CO_2e per year (without this co-gen the projected operating emissions are 3433 kt of CO_2e per year). What are AENV Climate Change group's comments regarding this? Under Section 3.4.8.5 Project Greenhouse Gas Management Plan (page 3-109), the ideas presented are adequate, but as this was the only place these have been noted, what will actually be done in practice, and why were they not addressed anywhere else?

11) Did the maximums of daily temperature and ozone occur on the same hour? Is a fair comparison being drawn? What does this look like when comparing the maximum ozone with corresponding temperature, and maximum temperature with corresponding ozone?

12) Is there more detailed emission data that has not been included? Please provide the information pertaining to this modelling?

13) Is there any indication that actual ammonia data may be collected in the future to address this problem?

14) How many pollutants were modeled using the CALPUFF model? Based on the example shown in Table 9 (pg. 39), only six chemical species were used and only three were emitted. Was this just an example presented and other models were not included? What was the emission properties of the other 123 pollutants looked at in this EIA?

15) Data on maximum pollutants are presented that exclude the existing open pit mines and upgrading complexes within the RSA. If these facilities are currently present, why remove them from the calculations of maximum pollutants?

16) What happens or what contingency will be in place to ensure that the time frame for flaring proposed by Shell is appropriate?

17) Understanding that some reductions are being applied for this project, what else is being done to help restrict the PAI load from increasing? What is being done to help reduce acid forming emissions or restrict emissions to the maximum level possible (Best Available Control Technology - BACT)? If

nothing is done, what is the expected timeline before the high buffering capacity of this region can no longer hold the potential load and irreversible effects begin?

18) Will Shell increase their monitoring efforts at the Fort McKay station to ensure levels do not keep increasing in concentration?

19) If there is a likelihood of increasing H_2S in the region, and noting the excessive number of exceedances (417 in 2008), what contingencies or services will be added to address the potential of future issues, especially for the residents (permanent or not) of Cabins J, K, and L?

20) What does Shell propose to potentially reduce the upward trend of THC?

21) Where are the source profiles for these heavy metals based on emissions? How many sources of these heavy metals were used?

22) With readings already noted above AAAQO in the region occurring for these species, is it fair to assume that the increase, even though small, can potentially lead to more exceedances in the region? How close do you allow before commenting on the value?

23) Why was there no mention of plans or reduction potentials to ensure compliance with CO_2 policies as per directions of AENV Climate Change Policy Unit and the Federal Government?

24) Based on these predicted exceedances, what is Shell going to do to reduce them? What is in place to ensure that a fleet retro-fit or change is going to be done?

25) What plans are in place to warn the people at Cabins h and k that there is a potential problem that could impact their location (specifically based on upset scenarios)?

26) Having grounds for potential odour issues, are there any standard protocols that will help follow-up in relation to odour issues raised in the region?

Monitoring and Follow Up

1) We recommend that AENV explain how and when the Approval terms and conditions will become sufficiently concrete to assure that the Mikisew Cree will be accommodated and that the continued exercise of their Treaty Rights will be protected.

2) We recommend that AENV develop terms and conditions of approvals that require specific parameters to be measured during monitoring so that the proponent concretely demonstrates the success of re-establishing TR.

3) We recommend that the Mikisew Cree is invited to comment on what the reclaimed vegetation scenario means to continuing their traditional resource use. Please discuss how the removal of wetland ecosites from the landscape for both the JEMA and the PRMA may alter the landscape, and hence TLU.

4) In order to complete a concrete plan on the re-establishment of TRs, Shell should document its understanding of how water resources after mine closure will accommodate traditional resource use, compared to baseline conditions. Furthermore, Shell should discuss with the Mikisew Cree how its plan will protect the continued exercise of Treaty Rights.

5) We recommend that Shell uses its own experience in the oil sands and its own methods and approaches that are already developed, and discuss with the Mikisew Cree how it intends to use this experience in developing concrete monitoring programs that test the effectiveness of mitigation. The mitigation should accommodate the FNs concerns. Shell should explain why it did not apply its concrete experience of the past programs and why only conceptual programs were presented in this EIA.

6) We recommend that Shell provide a concrete, not conceptual, monitoring plan that quantifies mitigation success, of which reclamation is a major part. This must include evidence that progress is being made towards reclamation targets using all proposed mitigation measures. Moreover, the progress being made with respect to reclamation needs to be demonstrated in terms of traditional resource use.

7) If the progression of wildlife recolonization is predictable, then please provide:

   - evidence that wildlife habitat utilization has been re-established, "*similar to that which existed prior to disturbance" (Quote from Approval 20809-01-00)*, anywhere in any operation of the oil sands region;
   - targets for wildlife habitat use and distribution after successful reclamation applied in Shell's monitoring programs;
   - measures of successful re-establishment of wildlife habitat utilization applied in Shell's monitoring programs; and
   - a demonstration that the reclaimed landscape will allow the continued exercise of Treaty Rights.

8) Alternatively, if such evidence and concrete targets and measures cannot be provided, please engage in dialogue with the Mikisew Cree to establish a process by which TLU can be re-established, setting up the required concrete and detailed plans to protect the continued exercise of Treaty Rights.

9) As such, the EIA for the JEMA and PRMA has not addressed Mikisew Cree concerns. Please explain how Shell intends to first collect, and then integrate, comments submitted by the Mikisew Cree in the strategic and operational plans of these two projects.

10) We recommend that Shell explain how it intends to use the input already provided by the Mikisew Cree. TLU and its re-establishment must be specifically highlighted in Shell's operational plans, including scheduling, progressive reclamation, design of reclamation programs, and monitoring of reclamation.

Reclamation

1) Please provide more specific targets, for the mean number of species, species composition, and percent cover of species within each ecosite/wetland type so that the success of reclamation can be fully evaluated.

2) Please discuss why traditional use plants were not included in reclamation planning directly.

3) What are the objectives of species composition? How does one know if species composition is progressing towards targeted ecosystems?

4) How many vegetation and wetland sites will be monitored? Will the full range of ecosite/wetland types planned in the closure landscape (as indicated in Tables 7, 11, 14, and 17 in Appendices 5-1 and 5-2) be monitored? What are the targets or thresholds for tree density, tree survivorship, tree height, tree condition, plant species composition, height, percent cover, and vigour that would indicate the achievement of reclamation procedures over time?

5) Why are the tables showing target ecosites in the closure landscape not provided and discussed in the C&R plan, as they will be useful in developing some predictions about reclamation success that can be tested and supported or rejected by the results of the monitoring program?

6) Will the Proponent use similarity coefficients to assess the similarity between each pre-disturbance and reclaimed ecosite/wetland types in terms of mean species richness (all plant types), species composition, and percent cover in each ecosite/wetland type? Will targets of similarity be established for each parameter so that the success of reclamation can be evaluated?

7) Will Shell include a more diverse array of upland ecosites as targets for the reclamation landscape such that the diversity of ecosite/wetland types is more representative of the pre-disturbance landscape?

8) Will the Proponent be more specific in terms of what is meant in reference to achieving equivalent land capability for these projects? Will a larger number of plant species be planted in each reclamation site during the initial stages of reclamation to ensure that the diversity and composition within reclaimed ecosites and wetlands is similar to that of pre-development ecosites and wetlands?

9) For each targeted ecosite/wetland type to be reclaimed, will the Proponent commit to planting or seeding a wider variety of species, with high similarity to that found in native ecosites/wetlands?

10) Can the Proponent provide direct evidence that plant species will emerge from the reclamation material (LFH) placed in reclaimed sites? If not, will this expectation be removed from the EIA and more species planted or seeded in early reclamation to ensure that a wide variety of species become established in each of the reclamation sites?

11) Will a greater number of plant species be planted or seeded during initial reclamation to ensure that the species composition of each reclaimed ecosite is similar to pre-disturbance ecosites?

12) Will the effects of dust be assessed specifically for traditional use plants, with tables for each LSA and the RSA showing pre-disturbance ecosite/wetland types, their traditional use plant potential rankings, and the amount of area in each that might be affected by dust from the Projects?

Regulatory Setting and Cumulative Effects

1) What is the rationale for a single EIA report in the context of the JEMA and PRMA?

2) Will additional off-site infrastructure and facilities be required for the shipping of ore and bitumen froth? Please explain and indicate where these were considered in the EIA report.

3) How will the Mikisew Cree be meaningfully involved by Shell in any process that alters or changes existing approvals?

4) Details regarding how continued, expanded, resource exploitation will be carried out in an "environmentally acceptable manner" are not apparent. Please elaborate and explain.

5) Please define the meaning of "*acceptable environmental and social effects*" as it relates to the Treaty Rights of the Mikisew Cree.

6) Please explain how previous commitments to monitoring, follow-up, and reclamation are impacted by the current application. For how long will the environmental impact predictions associated with the PRMA be valid?

7) What feedback has Shell received from FNs and the GoA regarding bitumen-fired cogeneration? Is Shell aware of other operators being denied the ability to use bitumen to fire steam generators? Does Shell believe that this is the most environmentally acceptable manner in which to exploit the resource? Will not the burning of bitumen result in the need for additional contaminant removal and subsequent storage or disposal?

8) What changes have been made to the tailings plan to comply with all aspects of Directive 074?

9) How will Shell consider actual pre-disturbance conditions (not current or baseline conditions) in its reclamation planning efforts?

10) What specific learnings exist from the Muskeg River Expansion and Jackpine Mine - Phase 1 that have been incorporated into current C&R Planning? Please elaborate and explain.

11) Please provide detailed C & R plan with targets and benchmarks and with strategies for monitoring progress. Such a plan should also contain alternative strategies should targets not be met. The plan should be based upon known successful C & R strategies and should include at minimum, lease-wide TR targets and associated temporal scenarios for reclamation, wildlife recolonization, revegetation, and wetland re-establishment The C & R plan should actively consider and utilize Mikisew Cree TEK.

12) What steps will Shell take to develop, at minimum, lease-wide targets and associated temporal scenarios for reclamation, wildlife recolonization, revegetation, and wetland re-establishment?

13) Given the lack of regulatory requirements for detailed planning (i.e., targets and associated temporal scenarios), it is not clear what is being done. Please elaborate and explain.

14) It is not apparent that cumulative effects to TLU from multiple crossings, water intakes, river encroachment by industrial activity and increased recreational use of the Athabasca River and the Athabasca River Valley were considered and addressed in the EIA report. Please elaborate and explain.

15) Provide a summary table that lists sources and dates of the last data updates.

16) In the map references, IHS Energy Ltd. (August 2006) was listed as a data source. Please provide a description of the data set?

17) Can Shell provide a CEA which focuses on the impacts of the projects on Traditional Land Use?

5.0 Literature Cited

AENV (Alberta Environment). 2000. Alberta Regeneration Survey Manual. Alberta Environment Publication No. 70. Forest Management Division. Edmonton, AB. 57 pp.

AENV and DFO (Alberta Environment and Fisheries and Oceans Canada). 2007. Water Management Framework: Instream flow needs and water management. Edmonton, AB., 37 pp.

AENV (Alberta Environment). 2008. Alberta Acid Deposition Management Framework, Edmonton, AB, ISBN: 978-0-7785-6725-7. February.

AENV (Alberta Environment). 2009. Guide to Providing Comments on Proposed Terms of Reference. EA Guide 2009-3.

AEP (Alberta Environmental Protection). 1995. Water Quality Based Effluent Limits Procedures Manual. Environmental Protection. Edmonton, Alberta.

Albian Sands Energy Inc. 2007. Muskeg River Mine, 2007 Environment Report.

Andison, D.W. 2003. Natural Levels of Forest Age-Class Variability on the Alberta-Pacific FMA. Prepared for Alberta-Pacific Forest Industries Inc. http://srd.alberta.ca/forests/pdf/alpac/Old_Forest_Report.pdf.

Andren, H. 1994. Effects of Habitat Fragmentation on Birds and Mammals in Landscapes with Different Proportions of Suitable Habitat: A Review. Oikos 71: 355-366.

ANPC (Alberta Native Plant Council). 2000. Guidelines for Rare Plant Surveys. Alberta Native Plant Council, Edmonton, AB.

ASRD (Alberta Sustainable Resource Development). 2009. Gene Conservation Plan for Native Trees of Alberta. Working group on native tree gene conservation in Alberta (Alberta Sustainable Resource Development and Alberta Tourism, Parks and Recreation). Pub. No. T/141. 108 pp. http://srd.alberta.ca/forests/default.aspx

Barton, B.A. 2005. Crude Oil Exposure and its Effects on Resident Fishes and Benthic Invertebrates in the Waskahigan River, Alberta. Unpubl. Rept. prepared for Can. Nat. Res. Ltd., Calgary, Alberta. Prep. by Appl. Aquat. Res. Ltd., Calgary, Alta. 67pp + App.

Beckingham, J.D. and J.H. Archibald. 1996. Field Guide to Ecosites of Northern Alberta. Canadian Forest Service, Northwest Region, Northern Forestry Centre.

Beven, K. 2001. How Far Can We Go in Distributed Hydrological Modelling. Hydrology and Earth System Sciences, Vol. 5 (1): 1–12.

Bridge, S.R.J. and Johnson, E.A. 2000. Geomorphic Principles of Terrain Organization and Vegetation Gradients. Journal of Vegetation Science 11: 57-70.

Burns, D.A. and G.B. Wiersma. 2004. Conceptual Basis of Environmental Monitoring Systems: A Geospatial Perspective. In: *Environmental monitoring* (Ed. by Wiersma, G. B.), pp. 1-35. Boca Raton, Florida: CRC Press.

Charron, I. and D.F. Greene. 2002. Post-wildfire Seedbeds and Tree Establishment in the Southern Mixedwood Boreal Forest. Canadian Journal of Forest Research 32: 1607-1615.

Chaves, H.M.L. and M.A. Nearing. 1991. Uncertainty Analysis of the WEPP Soil Erosion Model. Transactions of the ASAE. Vol. 34, no. 6, pp. 2437-2444.

Chipman, S.J. and E.A. Johnson. 2002. Understorey Vascular Plant Species Diversity in the Mixedwood Boreal Forest of Western Canada. Ecological Applications 12:588-601.

Council of Canadian Academies. 2009. The Sustainable Management of Groundwater in Canada. Ottawa, ON: 337pp.

Daly, C., W.P. Gibson, G.H. Taylor, G.L. Johnson and P. Pasteris. 2002. A Knowledge-based Approach to the Statistical Mapping of Climate. Climate Research, 22: 99-113.

Dillon Consulting Ltd. 2008. State of the Muskeg River Report. Prepared for CEMA.

Elshorbagy, A, J. Antarpreet, L. Bardour and J. Kells. 2005. System Dynamics Approach to Assess the Sustainability of Reclamation of Disturbed Watersheds. Civ. Eng., 32: 144-158.

Environment Canada. 1996. Guidance Document on the Interpretation and Application of Data for Environmental Toxicology. Environmental Protection, Conservation and Protection. Ottawa, Ontario.

Environment Canada. 1999. Guidance Document on the Application and Interpretation of Single-species Tests in Environmental Toxicology. Method Development and Applications Section, Environmental Technology Centre, Environment Canada. Ottawa, Ontario.

Fleeger, J.W., K.R. Carman, and R.M. Nisbet. 2003. Indirect Effects of Contaminants in Aquatic Ecosystems. The Science of the Total Environment 317:207-233.

Golder. 2006. Rare Plant Survey Technical Procedures.

Government of Alberta (GoA). 2000. Alberta Oilsands Consultations – Traditional Use Studies http://www.oilsandsconsultations.gov.ab.ca/docs/FACT_Traditional_Use_Studies(22).pdf

Government of Alberta (GoA) - Aboriginal Relations. 2007. Alberta's First Nations Consultation Guidelines on Land Management and Resource Development November 14, 2007 Final.

Government of Alberta (GoA). 2009. Historical Wildfire Database. http://www.srd.gov.ab.ca/wildfires/information/database.aspx

Guo, S. and A. Ying. 1997. Uncertainty Analysis of Impact of Climate Change on Hydrology and Water Resources. *In:* Sustainability of water resources under increasing uncertainty, Proceedings of the Fifth IAHS Scientific Assembly at Rabat, Morocco, April–May 1997, IAHS Publication. No. 240, 331-338.

Gutsell, S.L. and E.A. Johnson. 2002. Accurately Aging Trees and Examining their Height-growth Rates: Implications for Interpreting Forest Dynamics. Journal of Ecology 90: 153-166.

Hargis, C.D., J.A. Bisonette and J.L. Davis. 1998. The Behaviour of Landscape Metrics Commonly Used in the Study of Habitat Fragmentation. Landscape ecology 13: 167-186.

Headley, J.V. and D.W. McMartin. 2004. A Review of the Occurrence and Fate of Naphthenic Acids in Aquatic Environments. Journal of Environmental Science and Health Part A – Toxic/Hazardous Substances & Environmental Engineering, Vol. A39(8): 1989-2010.

Headley, J.V., S. Tanapat, G. Putz, and K.M. Peru. 2002. Biodegradation Kinetics of Geometric Isomers of Model Napththenic Acids in Athabasca River Water. Canadian Water Resources Journal 27:25-42.

http://www.aboriginal.alberta.ca/documents/First_Nations_and_Metis_Relations/First_Nations_Consultation_Guidelines_LM_RD.pdf

Imperial Oil Resources Ventures Limited. 2005. Application for the Imperial Oil Resources Ventures Limited (Imperial Oil) and ExxonMobil Canada Properties (ExxonMobil Canada) Kearl Oil Sands Project - Mine Development (Kearl Project), EIA Volume 6.

INAC. 2008. Aboriginal Consultation and Accommodation – Interim Guidelines for Federal Officials to Fulfill the Legal Duty to Consult. http://www.ainc-inac.gc.ca/ai/mr/is/acp/intgui-eng.asp

Johnson, E.A. and K. Miyanishi. 2008. Creating New Landscapes and Ecosystems. The Alberta Oil Sands. Ann. N.Y. Acad. Sci., 1134: 120-145.

Johnson, E.A. and S.L. Gutsell. 1994. Fire Frequency Methods, Models and Interpretations. Advances in Ecological Research 25:239-287.

Kennett, S.A. 2007. Next Steps for Cumulative Effects Management in Alberta's Athabasca Oil Sands Region. Resources, edited by Canadian Institute of Resource Law.

King, M.W.G., J. Barker, J.F. Devlin, B.J. Butler. 1999. Migration and Natural Fate of a Coal Tar Plume: 2. Mass Balance and Biodegradation Indicators. Journal of Contaminant Hydrology, Vol. 39, Issues 3-4.

King, M.W.G, and J.F. Barker. 1999. Migration and Natural Fate of a Coal Tar Creosote Plume: 1. Overview and Plume Development, Journal of Contaminant Hydrology, Vol. 39, Issues 3-4, pages 240-279.

Komers, P.E. 2002. Non-linear Responses of Ecosystem Components to Provide Threshold values For Cumulative Effects Management. In: *Proceedings if the Cumulative Environmental Effects management Conference in Calgary*, edited by A.J. Kennedy, November 2000.

LaPoint, T.W. and W.T. Waller. 2000. Field Assessment in Conjunction with Whole Effluent Toxicity Testing. Environmental Toxicology and Chemistry 19(1):14-24.

Leung, S.S.C., M.D. MacKinnon and R.E.H. Smith. 2003. The Ecological Effects of Naphthenic Acids and Salts on Phytoplankton from the Athabasca Oil Sands Region. Aquatic Toxicology 62:11-26.

McCuen, R.H. 1973. Component Sensitivity: A Tool for the Analysis of Complex Water Resources Systems. Water Resources Research, 9, 243-246.Suncor Energy Inc. 2005: Voyageur Project Application, EIA Volume 4.

Mikisew Cree First Nation v. Canada (Minister of Canadian Heritage), (2005) 3 S.C.R. 388, 2005 SCC 69.

Morrison-Saunders and Arts. 2004. Assessing Impacts, Handbook of EIA and SEA Follow-up. Earthscan.

MSES. 2007. Review of Shell Canada's Proposed Terms of Reference for the Jackpine Mine Expansion and Pierre River Mining Areas Environmental Impact Assessment, prepared for the Mikisew Cree First Nation IRC, August 2007.

National Energy Board. 2004. Canada's Oil Sands. Opportunities and Challenges to 2015. An energy market assessment. Cat. No. NE23-116/2004E, ISBN 0-662-36880-0.

Nybom, H. 2004. Comparison of Different Nuclear DNA Markers for Estimating Intraspecific Genetic Diversity in Plants. Molecular Ecology 13 (5): 1143-1155.

OSVRC (Oil Sands Vegetation Reclamation Committee). 1998. Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region. ISBN 0-7785-0411-5.

Passelac-Ross, M.M. and V. Potes. 2007. Crown Consultation with Aboriginal Peoples in Oil Sands Development: Is it adequate,is it legal? Canadian Institute of Resource Law, Occasional Paper, #19.

Reckhow, K.H. 1999. Water Quality Prediction and Probability Network Models. Canadian Journal of Fisheries and Aquatic Sciences 56:1150-1158.

Relyea, R. and J. Hoverman. 2006. Assessing the Ecology in Ecotoxicology: A Review and Synthesis in Freshwater Systems. Ecology Letters 9:1157-1171.

Schindler, D.W. and W.F. Donahue. 2006. An Impending Water Crisis in Canada's Western Prairie Provinces, US National Academy of Sciences, www.pnas.org/cgi/doi/10.1073/pnas.0601568103.

Schneider, R.R. 2002. Alternative Futures: Alberta's Boreal Forest at the Crossroads. The Federation of Alberta Naturalists. Edmonton, AB.

Siwik, P.L., T. Van Meer, M.D. MacKinnon, and C.T. Paszkowski. 2000. Growth of Fathead Minnows in Oilsand-processed Wastewater in Laboratory and Field. Environmental Toxicology and Chemistry 19(7):1837-1845.

Spies, R.B., J.J. Stegeman, D.E. Hinton, B. Woodin, R. Smolowitz, M. Okihiro, and D. Shea. 1996. Biomarkers of hydrocarbon exposure and sublethal effects in embiotocid from a natural petroleum seep in the Santa Barbara Channel. Aquatic Toxicology 34: 195-219.

Suncor Energy Inc. 2005. Voyageur Project Application and Environmental Impact Assessment. Submitted to Alberta Energy and Utilities Board and Alberta Environment. Fort McMurray, AB. Submitted March 2005.

Texas Commission on Environmental Quality. 2009. http://www.tceq.state.tx.us/implementation/tox/esl/list_main.html#esl_1

Van den Heuvel, M.R., M. Power, M.D. MacKinnon, and D.G. Dixon. 1999. Effects of oil sands related aquatic reclamation on yellow perch (Perca flavescens). II. Chemical and biochemical indicators of exposure to oil sands related waters. Canadian Journal of Fisheries and Aquatic Sciences 56: 1226-1233.

Walker, J. 2005. Status of the Arctic Grayling (*Thymallus arcticus*) in Alberta. Prep. By Alta. Sust. Res. Dev., Fish and Wildl. Div., and Alta. Cons. Assoc., Wildlife Status Report No. 57, Edmonton, AB. 41 pp.

Watson, E. and B.H. Luckman. 2004. Tree-ring Estimates of Mass Balance at Peyto Glacier for the Last Three Centuries. Quaternary Research, 62, 9-18.

Weir, J.M.H., E.A. Johnson and K. Miyanishi. 1999. Fire Frequency and the Spatial Age Mosaic of the Mixedwood Boreal Forest in Western Canada. Ecological Applications 10:1162-1177.

Yapa, P.D. and H.T. Shen. 1994. Modelling River Oil Spills: A Review. Journal of Hydraulic Research, Vol. 32(5): 765-782.

Personal Communications

Birkholtz, D. Freshwater Institute, Department of Fisheries and Oceans Canada, Winnipeg, MB. May 5, 2009.

Fort McKay and Mikisew Cree First Nation Elders and Landusers, Personal Communication with Jim Tanner.

McKillop, J. and C. Gates, Personal Communication with Jim Tanner.

Schindler, D. Professor, Biological Sciences Department, University of Alberta, Edmonton, AB. March 3, 2009.

Appendix A

Traditional Land Use and Socio-Economic Review: Twin River Consulting Report

Socio-Economic Review of the

Applications for Approval of the Jackpine Mine Expansion and Pierre River Mine

Of Shell Canada Energy

Review Prepared By

Twin River Consulting

May 31, 2009

Dr. James Tanner

Socio-economic Review

1 Socio-economic Review Context

The Jack Pine Mine Expansion and the Pierre River Mine Applications represent large increases in the volume of regional economic activity in the Wood Buffalo Municipality. A large percentage of the membership of the Mikisew Cree First Nation lives and practices their culture and land use within the municipality or immediately adjacent. Therefore it is likely that these projects will have adverse direct, indirect, and cumulative impacts on the environment and socio-economic conditions of the Mikisew People. **However, no direct assessment of these effects on the Mikisew Cree First Nation is included in the Applications.**

According to the Applications these two projects will increase the mined oil production by 300,000 barrels of oil per day which represents a major addition to the total mining activity in the region. These are only the most recent of a series of mining mega projects that have had or have the potential to have, adverse socio-economic effects on the Mikisew Cree First Nation and other aboriginal communities in the area. **Despite numerous requests and demands, neither the Crown nor the proponents of these mega projects have addressed the significant socio-economic impacts already imposed upon the Mikisew Cree First Nation and other Aboriginal communities in the area.** This major application represents additional potential impacts on the First Nation which should be assessed mitigated, minimized and compensated before any further projects go ahead.

In several other previous application processes the Mikisew Cree First Nation has asked for a full fledged impact assessment to be completed. However, instead of completing a proper and legal consultation and impact assessment process, representatives of the Crown have been attempting to negotiate an agreement wherein the First Nations would release the Crown from their current and previous obligations to consult in return for economic support opportunities for the First Nations.[1]

Meanwhile, Industry continues to bring applications for expansion and development to the regulators apparently in an effort to push these applications through despite the fact that consultation on previous regional projects has not been properly/meaningfully undertaken by the Crown. Since the Supreme Court of Canada has ruled that consultation processes should be completed before projects are approved, this review must not only discuss the specific aspects of the current applications but it should also present the requirements to bring the socio-economic consultation process up to date.

These two proposals represent an important turning point in the regulatory process for the reasons set out below:

1) These projects represent some major mines in the area. If these last few major projects are approved without addressing the likely impacts on the Mikisew Cree and other First Nations, including in respect of their section 35 rights and what is needed for the meaningful exercise of those rights, it will remove the ability of the First Nations to demand proper mitigation, compensation and alternative mining prospects since changes to these project should be made in the planning process. How can these effects be minimized if no proper assessment has been made to measure the impacts and if the EA expressly includes requiring the kind of information necessary to assess such impacts on Mikisew's section 35 rights? According to the consultation principles the projects should minimize the socio-economic effects and must plan to do so **before** the projects are approved.

2) The proposal forecasts that when the construction phase of these projects is finished the population of the region will level off. This is an important signal for the regulators and the aboriginal communities in the region. Oil sands production started in 1967 in this region. Since then the impacts and effects of this activity have been gradually pushing the First Nations people off these lands. Also, they have created significant cumulative socio-economic effects on their communities since the baseline year of 1965.

   These projects are severely changing the socio-economic base of the peoples without the required consultation. The issue is that there have been many major developments, renewals and new projects applied for and approved without proper assessment of the cumulative impacts on the aboriginal rights of the peoples in the region. Given the large scale of the environmental and socio-economic effects of these projects, it is obvious that projects have been approved by the Crown's representatives without the Crown fulfilling its consultation responsibilities with Aboriginal peoples. The fact that we are now nearing the end of a series of applications which have allowed industry to adversely affect major portions of the environment of northern Alberta and the traditional lands of these First Nations, should send a warning signal to both the Crown and the First Nations. The Crown should be concerned that the huge capital investments would be subject to the implications of their consultation failure(s) and the First Nations should be concerned that they will have no further opportunities to enforce their rights in

[1] These negotiations were the Long Term Benefits Agreement (LTBA) or the Consultation and regional benefits agreement (CRBA) negotiations and extended over a multi-year time horizon.

a meaningful way in areas "taken up" by these projects and will be left with the prospect of only claiming liquidated damages for socio-economic impacts.

3) The Jack Pine Mine Expansion may or may not include mining the Fort McKay First Nation reserve acreage. However, a proposal for the development of this reserve as a mine is included in these applications. This is an important aspect of this development because it places the Fort McKay First Nation in a very difficult position if that First Nation is agreeing to a mining project on their reserve lands. In all previous major mining applications in this area, the Fort McKay First Nation was the only First Nation upon which the companies focused their analysis of traditional land use, socio-economic and environmental effects. Impacts on other First Nations and Métis groups have been ignored or marginalized in favor of obtaining studies on and agreements with Fort McKay First Nation.[2] The emphasis on Fort McKay was based upon the proximity of the location of their reserve lands rather than comprehensive studies of impact on all of the aboriginal land use in the area or socio-economic effects based on First Nation population. The assessment of effects on only one First Nation is not adequate and distorts any clear understanding of the potential impacts or rights infringements on the other aboriginal people of the area. It also creates a conflict within the First Nations between those who will directly benefit from development and those who will suffer destruction of their lands. This conflict places more importance on the impact assessment of the Mikisew Cree First Nation representing approximately 50% of the total First Nation people in the area.

4) The proponent is applying for two projects at once. These two applications span both sides of the Athabasca River. One application is on the east side, the other on the west. There are likely different environmental and socio-economic effects for each project. It is likely that each of the two projects affects different land users and different communities differing amounts. There is also a concern on the part of MCFN that Shell may be engaged in project-splitting so as to limit the cumulative impacts of the two projects. There needs to be consultation with Mikisew and other potentially affected First Nations on this important issue.

5) Applying for two projects at once raises issues about the rate of development and the size of the impact. It not only raises cumulative effects issues between the two projects but raises the specter of the unregulated rate of economic development which has caused significant pressures on

[2] Although other First Nations have been included in the regional agreements and some peripheral work has been completed, the focus and assessment has been based upon the Fort McKay First Nation assuming that the impacts or infringement of other land users would be covered by assessing the impacts on local Fort McKay trappers.

infrastructure, employment issues, social disruption and cultural upheaval. All this activity is being proposed in cumulative addition to the plants already operating which are on-going and have not yet assessed their existing effects on the socio-economics of all these Aboriginal communities.

The review will discuss the information in the Applications in the context of the issues discussed above and it will also discuss gaps in that information..

2 Structure of this Review

Not Limited to Terms of Reference

This is a review of the proposal for approval of two projects located within the traditional lands of the Mikisew Cree First Nation. The proposal contains summaries and general descriptions of the projects as well as specific sections on the environment and the socio-economic conditions of the area. The objective here is to review the materials presented and to identify errors or omissions which should be corrected or added. Through the use of a TOR, the regulatory process may or may not require the Applicant to conduct studies required to fulfill the Crown consultation processes or conduct the consultation processes. However, these applications are for approval of projects that affect Aboriginal rights and must therefore consider if the proper consultation processes have occurred and what materials or information should be available for an adequate consultation process to take place. **This review will discuss the lack of information supplied to accomplish these requirements. It is noteworthy in this respect that AENV rejected including a number of references to aboriginal rights, and related information requirements, in Mikisew's suggested revisions to the TOR. Excluding such references does not make the need for such information go away in order to ensure that the EA is comprehensive and credible.**

No Separate Process

It has been the policy of Governments to establish a separate consultation process to deal specifically with consultation on Aboriginal Rights. However, there does not appear to be a separate consultation process for these applications. Moreover, if Alberta does intend to engage in such consultations, there is currently no mechanism or process in place to integrate the results of any such consultation into the regulatory process. Therefore, if the regulatory process is somehow not consistent with the legally required consultation process, it is important that these issues and omissions be identified at this time in this process so that the required proper consultation will take place. **Given the current state of this Application a separate consultation process should be established, including setting out how any results from that process would be integrated into the regulatory review and decision-making process.**

Rights versus Stakeholders

These applications do not assess the socio-economic issues on the basis of rights but instead tend to address issues as if the First Nations were merely stakeholders with no constitutionally-protected rights other than commercial rights (such as the trappers). However, it is clear that the Aboriginal groups in the area have constitutionally-protected rights that have different implications for the mitigation and planning process. The Supreme Court has stated that the First Nations in some cases have priority rights to use resources. Therefore, they may have special concerns related to land use and reclamation policies which must be seriously considered and substantially addressed. **The Applicant appears to treat the Mikisew Cree First Nation as a "stakeholder" rather than a rights holder who may have priority rights to the resources.**

Adequate Information for Rights Consultation and Accommodation

Generally, the socio-economic analysis in the Applications does not provide adequate information on Aboriginal practices, customs and traditions and socio-economic status to determine the effects of these projects on their Aboriginal rights. This is a problem partially caused by the structure of the regulatory system and the lack of specific responsibilities for Crown consultation. However, because there does not appear to be an independent Crown consultation process associated with these applications this process is the only process where such information can be obtained.

This review focuses on the summary and socio-economic sections of the proposals. Although topics like wildlife abundance, water and air quality, water quantity and habitat have important effects on socio-economic conditions, these sections are reviewed by others. However, this review does comment on the mechanisms that various factors influence socio-economic impacts.

3 Shell EIA and SEIA

Traditional Land Use Impacts

1. Summary - Quantitative Analysis of Impacts on Traditional Lands from Application

On a regional scale, the Project will increase the area of disturbance within the Athabasca First Nation and Mikisew Cree First Nation regional study areas by less than 1% each. Within all traditional use culturally significant ecosystems for Fort McKay First Nation, the Project will increase the area of disturbance by 2% for moderate use areas, and by less than 1% for the low use and intense use areas.

Reference: Summary – Shell Canada December 2007 - Section 17.10 page 17-18

In Volume 5 pages 8-4 Table 8.1-1 presents the quantitative summary of the estimates made by the Applicant of the increases in disturbances within a Regional Study Area (RSA). These totals state that the Mikisew Study Area is 8,634,755 hectares (100%) and that the Base Case Total Disturbance Area of 587,115 hectares (7%). The Application Case disturbance is estimated to be 32,494 (1%) or increasing the total to 619,609 (7%). Although these low percentages are presented in the Application, it does not state that there is any relationship between these percentages and the impact of these massive mines on the traditional livelihood or culture of the Aboriginal peoples affected.

A similar calculation is performed for the Athabasca Chipewyan First Nation but a different method is used for Fort McKay First Nation. The Fort McKay land use is outlined in three categories of area, a low use area, moderate use area and intense use area. Each of these categories is compared to the area which is disturbed in the base case and in the project and Application cases. The application Case shows that in the moderate and intensive Fort McKay land use 21 and 28 percent of these lands are disturbed.

The Application does not include explanation of the implications of these relative disturbances on the land use of the First Nations or Métis. Assessing the impacts is in fact the most important part of any SEIA. **What are the implications of this project for the continued and future traditional land use of the First Nations? We note, in particular, that the Application does not consider the impacts of the "taking up" of other lands within the Traditional Territory of MCFN and what impacts this has on the exercise of Mikisew's section 35 rights. Absent an understanding of the impacts of the grants of tenure, developments of various kinds on those lands, and what is required for Mikisew to meaningfully exercise their rights in the future, it is difficult to understand the direct, indirect, and cumulative impacts of the Application on Mikisew's rights.**

Mikisew Cree Study Area

The Application states that the Mikisew RSA is based upon the Traditional Territories of the Mikisew Cree First Nation. It is well known that the total area that the Mikisew Cree People have historically used extends well into the Northwest Territories, covers parts of Saskatchewan and a large portion of northeastern Alberta. In Aboriginal times and well into the fur trade, the Chipewyan People were some of the most nomadic hunters on the planet and the Cree People covered large areas especially after the advent of the trade.[3] However, as hunting methods changed over time and after several periods of settlement so did patterns of land use. The use of the number of hectares in the historical traditional territories of the Mikisew Cree First Nation as a denominator in an calculation to measure current impacts to the Mikisew Cree First Nation land use is absurd and, at best, at best unscientific. It is not based on an informed approach to the study of land use by aboriginal people and is clearly an unacceptable method for assessing impacts. This renders the result absurd and unscientific and would prevent the application from making any reasonable implication of impacts from these calculations. To be clear, this kind of analysis assumes that Mikisew members can easily exercise their rights anywhere within their Traditional Territory. It ignores the realities of actual land use patterns, the ability of Mikisew members to exercise their rights based on where they live, and other relevant data. Furthermore, this sort of approach makes exactly the kind of error that the Supreme Court of Canada cautioned against in the *Mikisew* case – telling aboriginal people that they can simply "go elsewhere" to practice their rights. Just as we would not expect adverse environmental cross-border impacts coming from the United States, such as from a new smeltering plant, to be ignored because that plant would affect 0000.1% of Canada's land base, it is equally troubling to seek to minimize impacts on Mikisew's actual land use by using essentially the same sort of analysis.

Method Used to Quantitatively Assess Impacts on Fort McKay First Nation

Data Problems

The method that has been used to measure the relative impact on the traditional land use of Fort McKay is based upon an attempt at measuring concentrations of activities of this First Nation and therefore is based upon a rational premise which attempts at looking at the cultural aspects of land use in more detail. However, the effectiveness of this method is dependent upon the manner in which this method is applied. The researchers who have provided these data have admitted that the data acquisition methods do not allow one to confirm the data because the Elders were not individually identified.[4] No controls were introduced in the data collection

[3] The Mikisew Cree First Nation is made up of both Cree and Chipewyan heritage.
[4] Personal discussions with interviewers and participants.

process to determine if the data came from a balanced sample of land users or a large enough sample of land users. In addition those who provided the data may have not provided a number of icons proportionate to their relative land use intensity. Therefore, the most that can be said of this data is that it may be a rough approximation of the land use of a sample of land users from Fort McKay First Nation. There may be important differences if it were possible to gather this data again in a more systematic fashion.

Methodological Problems

In order to measure impacts of industrial activities on land use, one must become familiar with the specific land use processes, the seasonal nature of the use and the connections between one activity and another, as well as the cultural importance of the land to First Nations. Assuming that impacts are fairly similar for aboriginal and non-aboriginal users of the land misses entirely the unique concerns of First Nations. Using an analysis of the location of icons is subject to misuse creating very large errors. Icons only help to build a spatial model of the land use of a particular group. The model must include information about the quantity and frequency of harvesting. The question which must be asked is what each icon represents to the livelihood of the group. Is the "value" of a moose icon the same as a fish or muskrat? If the rule of placing an icon is to identify each separate activity then a moose icon is clearly of different value that a muskrat or one fish. However, the intensity maps unwittingly assume that each icon is of equivalent value.[5] This error alone is enough to destroy the usefulness of the analysis but there are other problems with the methods used.

Effects on fishing are a good example of the lack of using a proper model of assumptions. Fishing may be affected by impacts that have little or nothing to do with the disturbance of land but may have to do with historical spills and the perception about the quantity and quality of the water. In Volume 4A, page 6-29, the Applicant claims that "*no residual impacts of the Project to fish and fish habitat diversity are expected for the Athabasca River."* They go further to imply that because of this conclusion there will be no effect upon the ability of the First Nations to continue their traditional livelihood. In fact, Elders in most communities including Fort McKay and Mikisew Cree First Nation have reported that they have stopped fishing on the Athabasca River downstream from the major area of disturbance shortly after the historical Suncor oil spill.[6] Therefore, it may be true that this project will not have additional incremental effects on fishing on this portion of the Athabasca River because fishing for food has already been adversely affected. The percentage of land disturbance or water quality will not provide information on this traditional use based on cultural reasons and because this portion has already been destroyed. What this approach ignores, however, is that if further development on this scale were not approved, it might be possible to start to mitigate the impacts of development on fishing. We do not suggest this would be easy; however, allowing more and more development

[5] Discussions with J. McKillop and Cormack Gates
[6] Interviews with Fort McKay and Mikisew Cree First Nation Elders and Land users.

to occur makes this extremely difficult. This also demonstrates the problem with allowing companies to use an "already disturbed" baseline – using that approach minimizes the incremental or cumulative impacts of yet more development.

There still may be fishing activities in other areas that the project is affecting. What will be the effects on other areas of fishing activity and the community food supply by these projects? In order to assess this it is not enough to simply comment on the quality of the water, but one must look at access, cultural issues, seasonal timing and also physical and chemical effects.

Seasonal and sequential activities in traditional land use are very important. If a specific area is not available at a specific time it may affect the behavior of the hunter because he cannot conduct an intermediate occupation or use a particular route to his hunting destination. If one area is disturbed it may lessen activities or adjacent areas that are still not entirely disturbed. The land use patterns and associated activities must be understood in order to understand the complete effect on traditional land use. In the example of Fort McKay where 28 percent of the intensively used area is disturbed it may cause a 50% decline in total land use. A 50% decline in use may cause a cultural collapse of the system due to an economic or social tipping point. This cannot be assessed using the methods contained in this Application. The use of the land may not be proportional and is not likely to be proportional to the percentage of land disturbed even if good numbers were used in the calculations.

Response: Has the Applicant studied the cultural traditional land use of the First Nations enough to be able to model and assess the impacts of the project on traditional land use tipping points?

Summary of Problems with the Quantification of Impacts on Traditional Land Use

The method used to attempt to measure the relative impact of the Projects effects on the land use of the Mikisew Cree is unscientific and based upon misunderstandings. The methods used to assess the Fort McKay First Nation traditional land use are based upon a rational approach but do not include enough information about the land use process to allow appropriate estimates of effects.

Recommendation: In order for a proper impact assessment to be undertaken a full consultation process as described below must be completed. (See Below) Useful conclusions cannot be made using the methods contained in the current application.

TLU Impact Mitigation by Shell

The Applicant has proposed to introduce some mitigation measures to attenuate the impacts on First Nations. In volume 5, page 8-6, the Applicant states that they will continue to participate in the End Land Use and Conservation and Reclamation Agreement with Fort McKay First Nation and the Fort McKay Métis Association.

Note that this participation does not mention any participation in reclamation consultation with the Mikisew Cree First Nation.

CEMA

The Application states that Shell will continue to participate in multi-stakeholder planning and research initiatives. On Page 8-17 of Volume 5, the Applicant makes mention that Shell will continue to participate in multi-stakeholder organizations such as CEMA. Note that at this point participation in the CEMA TEK Committee is only for the benefit of Shell since Mikisew Cree and other First Nations have resigned from participation in this committee because of its refusal to deal with Aboriginal issues in proper cultural context.

There are problems that relate to promising to accelerate reclamation.

In section 8.7.7 of Volume 5, page 8.242 the proponent proposes to reduce the occupation of the lands by attempting to provide early reclamation and to minimize the impacts of the mining process while they are operating where possible.

Although this appears to be consistent with a noble goal of minimizing effects it must be viewed in perspective. The length of time that actual effects of developments on aboriginal traditional use will last arguably generations. The short incremental period where lands will be reclaimed early in the far future will have little or no effect on the practical land use opportunities for these First Nations. The First Nations are essentially being told to suspend or ignore their rights in important parts of their traditional territory and to just "trust" that reclamation will work. There is no analysis of what it means culturally, economically, and socially to essentially require people to either suspend or fundamentally alter their patterns of land use in terms of the viability and sustainability of that culture. The issues that must be addressed, which would quickly be identified through a proper consultation impacts study, are the ability of the First Nations to maintain and meaningfully practice the traditional activities and cultural knowledge and to transmit this to younger generations over the period of the most intensive impacts. If this transfer of knowledge is not successful the quantity or timing of the questionable reclamation of lands will be moot.

TEK collection projects and supporting cultural gatherings and programs.

The First Nations in the ATC have been very willing to share TEK in an effort to assist the planning and reclamation aspects of the proposed project in the area despite the enormous

negative effects these project have had on their lands. TEK gathering can be an important part of the maintenance of culture and continued traditional land use. However, the emphasis on TEK gathering has been to support the environmental analysis required for regulatory planning rather than supporting on-going traditional land use. The lack of responsiveness of the regional associations and the proponents of projects in acknowledging the importance of the Aboriginal right to maintain their traditional land use and maintain their TEK was the impetus for resigning from the CEMA TEK Committee.

References: Traditional land use effects: page 149 of the EIA Update:

Examples of the proposed mitigation included in the Application are as follows: progressive reclamation, maintaining trappers access to their trap lines on the Project perimeter, compensation to trappers directly affected by JME and PRM, agreements with First Nations, and others. In addition, Shell will continue to support community initiatives that contribute to the preservation of Aboriginal culture.

Summary Conclusions TLU

Mikisew is concerned about mitigation proposals put forward by individual companies and having regulators and decision-makers consider them adequate while companies continue to apply for more projects without conducting a full impact assessment or socio-economic study of impacts. This is simply not an acceptable response and denies the aboriginal rights of the Mikisew Cree First Nation.

Only by focusing on potential impacts on constitutionally-protected rights through a proper consultation process and living up to the legal responsibilities as dictated by the Supreme Court of Canada will provide the support adequate to preserve the Aboriginal culture, and allow the First Nations to exercise their right to maintain their traditional land use.

4 Socio-economic Impacts

Introduction

The socio-economic impacts on the Mikisew Cree First Nation cannot be separated from an understanding and appreciation of their Aboriginal rights. Participation in the industrial, commercial and residential economies is inevitable and has been part of the history of the First Nation since their participation in the fur trade starting in the 18th century. However, the First Nation also has the right to maintain and develop its culture, language and traditional livelihood in association and coincidental with participation in the industrial economy. This may imply different approaches to many issues including health, housing organization, socio-economic organization, reasons for leave from work and may other culturally related factors.

As a result the socio-economic impacts on the Mikisew Cree First Nation include impacts on the cost and availability of housing but also the location and characteristics of the housing. In order to assess the impacts of such a development on the Mikisew Cree First Nation a thorough understanding of the First Nation rights is required.

Issues Identified in Application

In Section 18-2, page 18-6 the Application presents issues that were identified by First Nations.

Regionally, the key socio-economic issues are:

Employment training
Population effects on total and regional service providers
Transportation and other infrastructure
Access to land and land use[7]
Regional and provincial benefits

In addition to these key regional issues, First Nations and Métis issues and concerns include:

Access to education and training opportunities
Access to economic development opportunities
The retention of Aboriginal culture

[7] Although access to traditional hunting, trapping, fishing and gathering areas is an important consideration, what is missing entirely from the EA (as previously noted) is an analysis of what is needed to sustain those rights today and into the future.

Physical infrastructure requirements
Safety

Summary of traditional Land and Cultural Impacts

-removing land from traditional uses by means of mines, and in situ field facilities, plant sites and transportation networks.

-increasing the regional population, and increasing access to places that were previously difficult to access. This will likely increase competition for traditional resources.

-providing wage economy opportunities for local Aboriginal people, which will likely reduce their involvement in traditional pursuits.

Rights Holder versus Stakeholder:

The approach that has been taken by the Applicant in obtaining this information is similar to the approach which would be taken in typical stakeholder consultation process where the stakeholder did not possess affected aboriginal rights. This type of approach is inadequate when there are impacts on rights. First, the extent of the right must be identified based on requiring the proponent to collect and consider information relating to what is needed to exercise that right or rights in a meaningful fashion, then the impacts on the right assessed, then consultation must occur to determine how mitigation, compensation and preferred adaptation should occur. Given the potential cumulative impacts of development on Mikisew's rights, a single proponent may not be able to collect the required information, which is why, for years, Mikisew and other First Nations have been calling for one or more regional baseline studies involving other proponents and the federal and provincial governments. The comments above, although they may contain some of the expressed interests and desires of the First Nation, do not adequately address the socio-economic impacts upon the Mikisew Cree First Nation and their rights.

The Application outlines some issues:

Housing:

"Affordable housing is expected to remain scarce."
SEIA: Page 18-14

One of the proposed solutions for a continued housing shortage accompanied by high prices is to make more complete use of the recently completed Albian Village located at the Muskeg River Project and to construct a residential camp on the Pierre River Mine site.

Shell's Solutions:
-Albian village: capacity 2,500 workers
-Pierre River will have an on-site camp

-Jackpine will not have a camp and the workers will be expected to find accommodation in Fort McMurray.

Response: Mikisew Cree First Nation people have been forced off the lands by industrial development and many are unable to find affordable housing in Fort McMurray which prevents them from taking advantage of employment opportunities. Housing that would be available is too expensive, not available and not culturally appropriate.

Recommendations:

1. The Government and Industry should work together with the First Nation to acquire and develop lands in the Fort McMurray region allowing the First Nation to construct and make available appropriate housing for the hundreds of Mikisew members living in Fort McMurray.
2. Industry should work with the First Nation to build appropriate aboriginal housing in satellite communities on a joint venture basis with the First Nation.

Education

The Application identifies a problem which is well known to the Mikisew community.

> *"**Rural** schools report issues including low student performance, high dropout rates and students finding the transition to high schools in Fort McMurray difficult." (emphasis added)* Reference: Page 8-250 Volume 5.

Education has been mentioned as part of the impact mitigation strategy several times. However, education in general is not considered to be a responsibility of the industrial sector except perhaps in the field of training. In a more appropriate consultation process the Applicant would provide information in the SEIA which:

1) Outlined the number of students in each community who held aboriginal rights.
2) Identify those students who have been affected or will be affected by the industrial developments included in the base and application cases.
3) Identify how these students have been affected, such as that their parents are homeless, or unable to find suitable accommodation or unemployed or they are having trouble adjusting to living in a city rather than a small community, etc.
4) What levels of education have these students obtained? What current prospects do the students have with the historical success with the current education programs?

Proposed Mitigation: Shell has proposed that they continue their support for various programs such as scholarships, job training and cultural retention workshops. Shell has specific programs noted on page 8-277 of Volume 5 of the Application.

Response: There is not enough information or analysis provided in the Application to provide further analysis or strategy to properly fulfill a consultation responsibility on educational effects and problems and how to address them.

Recommendation: A full socio-economic study in association with a proper consultation process should identify the problems and causes of educational shortfalls. This will allow a thorough and coordinated mitigation plan to be developed.

Social Services

The Applicant mentions that there are social service problems associated with the growth and current situation in the Municipality. *"Generally, the social services available in outlying rural communities indicate that they have limited staff and financial resources to service their clients."* Page 8-254, Volume 5.

The social service problems include homelessness, reduced community life, problems from a transient population and alcohol and drug use.

Response: The solutions that have been proposed by Shell appear to be focused on providing on- site residential camps for Shell workers.

Recommendation: A full consultation process should be initiated which will assist all parties in identifying mitigation measures that directly address the socio-economic problems of the area, including information from a First Nations perspective.

Health Service

The Applicant identifies that the health services are having and will continue to have difficulty in recruiting and retaining staff particularly in **rural** and isolated communities.
Reference: Page 8-257 Section 8.7.11 Volume 5.

Shell is proposing that one mitigation factor will be the establishment of onsite medical care for Shell employees. Shell suggests that this will reduce the pressure on local medical facilities.

Response: Given the higher rates of cancer and other problems reported in one of the rural communities, how will providing better care for Shell employees assist the on-going impacts on rural health services in the area?

Recommendation: Mitigation proposals should directly address the issue of attracting and keeping qualified staff at rural medical centers.

Emergency Services

Shell notes that they are some challenges in maintaining adequate emergency response services especially in **rural** communities. Reference: Page 8-260, Section 8.7.12, Volume 5.

Response: There appears to be a pattern in the Application in describing shortfalls in socio-economic services. The rural problems seem to be prevalent.

Recommendation: The question is: are the rural communities adequately serviced in the emergency, health and education fields?

Transportation:

Shell analyses the mortality and accident rates of highways in the McMurray region and discusses the road transportation plans. There is no comment on transportation to and from Fort Chipewyan either by air or by boat and no analysis of the winter road.
Reference: Page 8-263, Section 8.7.13, Volume 5.

Response: The First Nations in the area have a right to maintain their traditional transportation in order to exercise their rights. This has not been discussed in the Application.

Recommendation: Proper study of the transportation rights should be included in the consultation process.

Socio-economic Statistics

Employment: Reference Page 8-211 of Volume 5.

The Application does provide some aggregate statistics on employment of Aboriginal peoples and compares those statistics with average Alberta percentages.

They note that the average off reserve unemployment rates in Alberta for Aboriginal peoples is 7.3 % where the average unemployment rate for the wood Buffalo – Cold Lake Region of Alberta is 5.3% which was above the 3.6% unemployment in the Province as a whole. (September 2007).

They note that on reserve unemployment is higher with a report from ATC estimating unemployment to be in the range of 38 to 54%. Given the opportunities and lack of

unemployment generally in the region, these figures are extremely high. There is no more detailed analysis of these statistics provided in the Application.

The Application notes that the ATC Study identifies four barriers to employment. Two of these are associated with lack of education and or no driver's license. However, it reports that 26% of respondents indicated that they face drug/alcohol tests as a barrier to employment.

Response: There is no further discussion of the causes of this situation or discussion of the socio-economic setting which would allow mitigation proposals to be made and carried out in a meaningful fashion.

Recommendation: The causes of income disparity should be studies and the role of this Project and others discussed in that study context.

Income: Reference: Page 8-212 Volume 5.

The Application provides estimates of average income for the region for Aboriginal people and compares that with the average for Alberta. The presentation notes that the levels of single family incomes is much higher in the rural communities and that those single family incomes are much lower than the Province and much lower than the average for Fort McMurray. What is not explicitly stated is that these numbers suggest a breakdown in the family structure in the rural communities and that there is a large income disparity between the average for Fort McMurray and the rural communities that appears to be related to the family structure.

Response: The Application does not discuss the causes of this disparity or discuss how the project specific or cumulative effects of development have contributed to this situation.

Recommendation: These figures show considerable disparity yet there is no analysis or explanation for why this is so or if this has to do with the development of the area. The analysis of the effects on development on family structure and income especially in the rural areas should be undertaken.

Socio-economics of Water

Use of Water is important from a **socio-economic** point of view for several reasons:

Athabasca River issues are:

1) **Transportation**: Surface access to Fort Chipewyan is only via the Rivers when the winter road is closed.
2) **Fish consumption**: One of the most important traditional foods is fish.
3) **Seasonal flooding** to create habitat for fish and other animals: Lower volumes of water in the Athabasca River could affect the frequency of important flooding cycles.

The application discusses the issue of water quality and quantity within the Athabasca River but does not address the issue of transportation on the River. (See Application Volumes on water quality and quantity)

There is no assessment of the navigability of the River in the application. One of the aspects of this issue is that water quality is affected by dredging and the issue of both traditional and commercial transportation should be weighed against environmental effects and socio-economic impacts. Specifically, transportation on the River could be quite important in the future for both the community of Fort Chipewyan and the Industry in the region. Water is being removed from the River. This will reduce the ability of impurities to be diluted and affect the possible transportation on the River without dredging. Dredging however is suspected to be one of the causes of high levels of mercury in the water which has devastating effects upon the traditional fishery.

The traditional activities of the Mikisew Cree First Nation require certain levels of the quantity and quality of water. Oil sands use of this water represents an economic and social loss to the Mikisew Cree First Nation.

Response: What is the economic and environmental loss (or opportunity cost) of the use of water for the production of oil sands rather than being available to support traditional and cultural activities?

Recommendation: An analysis of the implications of water on each of the socio-economic issues outlined above. These issues do not appear to be discussed in the EIA nor the SEIA.

5 General Mitigation responses

Issue: General Socio-economic Mitigation Initiatives and Proposals

Reference: On page 136 of the EIA update, the applicant lists several initiatives in the Wood Buffalo region to alleviate the pressures of rapid growth and enhance the quality of life of local residents (GOA 2008a).

− addressing traffic congestion in and around Fort McMurray with the construction of major highway interchanges ($300 million);
− expanding long-term, ambulatory and emergency care ($49 million);
− support for policing ($9 million);
− contributions to a new child care facility ($2 million);
− school buildings ($14 million); and
− wastewater and solid waste infrastructure ($45 million).
-$0.9 million affordable housing funding to the Wood Buffalo Housing and Development Corporation (GOA 2008b).

How do these initiatives impact the members of the Mikisew Cree First Nation?

In this context, the applicant lists a number of projects:

-A 20-year Strategic Capital Plan with an average annual commitment of $6 billion to meet infrastructure needs (GOA 2008c). Specific capital projects will be announced through the regular budgeting process. The plan outlines long-term priorities and reaffirms current Alberta government commitments in the following areas:

− municipal infrastructure, e.g., support for high-growth areas, such as Wood Buffalo, support through the Municipal Sustainability Initiative and other municipal grant programs;

− the provincial highway network, other transportation, and corridors, e.g., new Highway 63 section north of Fort McMurray, east-west travel routes by extending Highway 686 and construction of a new highway between Fort McMurray and Peerless Lake, improvements of Highway 813 in Wood Buffalo region;

− health facilities, e.g., new primary health care centres in Wood Buffalo;

− schools, e.g., modernization of Westwood Community High School and construction of two new high-schools in Fort McMurray post-secondary facilities, e.g., commitment to technical trades and health workforce training;

− housing and government projects, e.g., commitments under the Municipal Sustainable Housing Program, Affordable Housing Program and the Alberta Secretariat for Action on Homelessness ($285 million announced on January 23, 2008 to address immediate housing pressures, GOA 2008e);
− community facilities, e.g., commitments under Alberta's Cultural Policy, Major Community Facilities Program and Community Facilities Enhancement Program; and
− water and wastewater facilities, e.g., commitments under the Water for Life strategy, the Municipal Water/Wastewater Partnership program.

What infrastructure projects will assist the Mikisew Cree First Nation to address the impacts of these developments?

• Continued commitment to trades training, addressing key labour shortages in the province, and engagement of Alberta's untapped labour force. On January 31, 2008, the Government of Alberta announced $1.5 million towards the completion of training facility for women entering trades.

The facility, operated by Women Building Futures – a non-profit organization – will provide 400 spaces annually for women who wish to achieve economic independence through trades training (GOA 2008f).

• Support for carbon capture and storage under the Alberta Climate Change plan which aims to reduce emissions by 50 percent by 2050. Funding for carbon capture and storage, energy conservation, and green energy production will be allocated thought the Canada ecoTrust and the Climate Change and Emissions Management Fund (GOA 2008i).

• Phase-out of Alberta health premiums in the next four years which will translate into savings of $1,056 for families and $528 for individuals (GOA 2008g).

• Support to low-income earners through an increase in Alberta's minimum wage to $8.40 per hour (GOA 2008h).

The federal government is also responding to the growth pressures in the region, including cost sharing with the provincial government of the twinning of Highway 63 and providing living allowances to civilian and uniformed RCMP employees in Fort McMurray. See Volume 5, Section 8.7.3 of the EIA for details.
A new initiative by the federal government is additional joint funding under the Canada-Alberta Affordable Housing Program to the Wood Buffalo Housing and Development Corporation. The federal government's share was $0.9 million.

Do any of these projects and initiatives address the impacts on the Mikisew Cree First Nation?

What are the total expenditures on these initiatives and what percentage of these expenditures will assist the Mikisew Cree First Nation?

How do the major capacity and Infrastructure Projects address the Mikisew Cree First Nation concerns?

Applicant Mitigation Approach

Shell will adopt construction and operations practices that limit the impact of its workers with local communities, such as full-service camps, expanded work schedules with adequate break periods to allow for travel to place of permanent residence. During operations, Shell employees will have access to the company's confidential assistance plan and specialized expertise. To constrain the impact of development on small Aboriginal communities, Shell will continue to assess and support, where warranted, a number of cultural retention initiatives.

To mitigate health service pressures associated with the Project, Shell is considering the expansion of the current on-site health care facility at the Albian Sands Village to serve the enlarged Jackpine Mine workforce, and the construction of a similar facility at the PRM site. These facilities are expected to reduce the number of people from outside the region that use emergency room services in Fort McMurray. Reference: Page 154, EIA Update:

How do Shell's mitigation proposals assist of mitigate the Mikisew Cree First Nation in dealing with the impacts of the projects?

Discussion: The **r**egional initiatives presented above are primarily directed to the general capacity and infrastructure shortfalls in the Fort McMurray region. However, as noted in the Application and pointed out in several sections of this review, many of the most serious problems in the Municipality occur in the **rural** regions where many of the Mikisew Cree First Nation People reside. The Application points out the difficulties of obtaining staff for schools, social services and medical facilities in isolated and rural locations. There are additional problems associated with emergency services in rural communities (Volunteer fire departments and medical emergency response facilities.) School and recreational services and infrastructure appear to be focused on the Fort McMurray area. It appears that the greatest need for mitigation and infrastructure is in the rural areas yet these areas appear to be left out of the major mitigation and infrastructure projects.

Summary of the SEIA Analysis

The Application has not dealt with the First Nation on the basis of rights but rather Mikisew has been treated like a rural stakeholder. The rights of the First Nation from a socio-economic point of view appear to be ignored. However, consultation on these rights is required before such an application can be approved. A major socio-economic study is required in order to prepare for a proper consultation process. The Application does not include the materials required to support that process. The application does, however, make it clear that the rural regions of the Municipality appear to have the most pressing socio-economic problems but it does not discuss how those problems are related to the project or cumulative effects of development. An outline of some of the additional data requirements to answer these important questions is included below.

6. Analysis of the assessment of Impacts

The information and data collected for the purposes of this application is far from adequate in supporting an appropriate consultation process for the socio-economic impacts of this project on the Mikisew Cree First Nation. Even if there were a separate Crown consultation process, which there does not appear to be, the information should be collected by the proponent, other proponents, and the federal and provincial governments through a larger baseline study to show the potential effects on the First Nation. This has not been done in this application.

The following is a list of the types of information which should be collected in order to accomplish a proper consultation process.

The information required could be categorized into baseline information, cumulative impacts information and Application effects information. The consultation process needs sufficient information to be able to measure the impacts and to value the impacts.

Once this process has been completed there should be an opportunity for all parties to discuss and agree on minimization strategies and mitigation strategies. A discussion of accommodation options would then take place between the Crown and the First Nation.

This process must be completed before the project proceeds so that questions like **"Are there any places or activities which need to be preserved which require a reduction in mining or a change in proposal scope?"** can be dealt with before the project operations renders them moot.

Information required for Baseline study

A. 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 land Use:

(i) Define Traditional Land Use study area[8] 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 study area 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 currently and 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

(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

[8] 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. Please not that a study area is not an area that defines the traditional lands.

(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 and information about the traditional, cultural and spiritual aspects of land use (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 together with explanations describing the reasons why cultural and spiritual locations have changed.

(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) Traditional Social Structure

(i) Information on sharing of traditional foods

(ii) Information on the social structure of hunting and gathering

(iii) Information on the relationship between hunting, gathering and trapping and the seasonal cycles of traditional land use

(iv) The changes in these traditional activities over time and the causes of the changes.

(v) The basic cost structure of traditional hunting and trapping and gathering from 40, 20 and 10 years ago. Costs should be measured in money and time

(i) 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

(j)

(k) Occupations

(i) Number of individuals involved in traditional occupations and percentage involvement (full time, part time, weekends)

(ii) Involvement in private wage employment

(iii) Involved in private businesses

(iv) Employment by Band

(v) Employment by Government

(vi) Studying

(vii) Unemployed

(viii) Domestic work

(l) 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.

(m) Personal and Family 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 members employed in resource sector

(v) Changes in number of people employed in resource sector from 40, 20 and 10 years ago

(n) Educational and Training Information

(i) Level of education by location (Include traditional knowledge)

(ii) Level of training or skills by location (Include traditional knowledge)

(iii) Percentage enrolled in education or training (Include traditional activities)

(o) Health Information:

(i) First Nation health problems 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) Structure and changes in diet including types of traditional foods 40, 20 and 10 years ago

(vi) Health problems and causes of death compared to regional population

B. 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 same[9]

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

[9] 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.

(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 land 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

(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

(i) Impacts of climate change within the area of the Plan/within our Traditional Territories

Appendix B

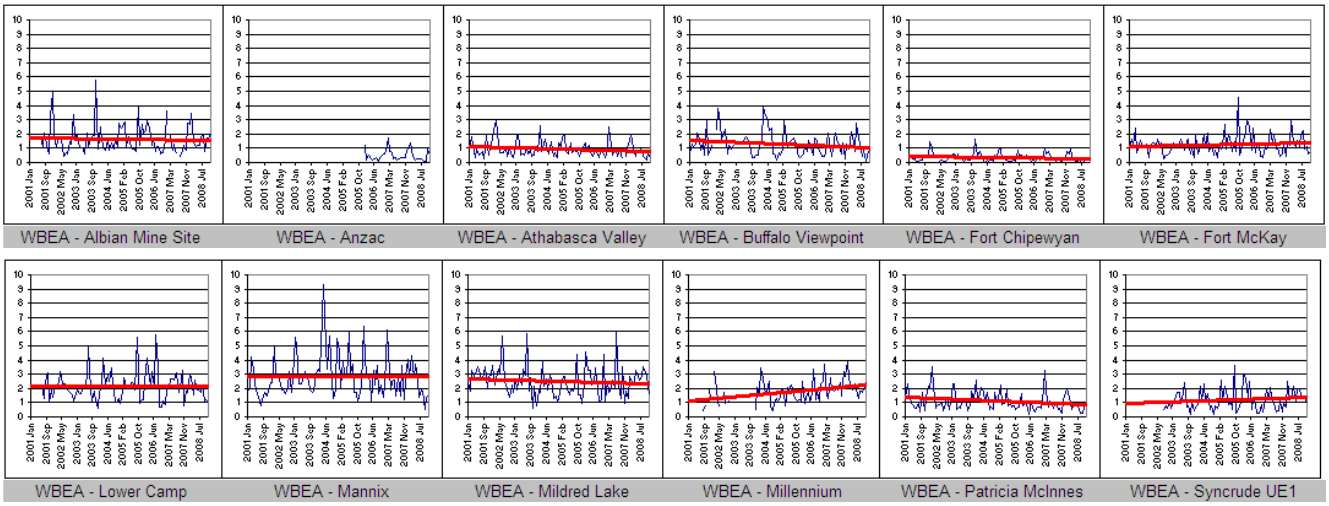
Air Quality Review: Summarized Ambient Monitoring Results

Issue: Sulphur Dioxide Air Quality

Reference: EIA Appendix 3, Appendix 3-7, Existing Air Quality and Meteorology, Section 2.1 Continuous Ambient Monitoring, 2.1.1 Sulphur Dioxide Concentrations, pg 5

Concern: Demonstrations of maximum 1-hr averages are very high, with one occurrence showing a reading 4 times above the AAAQO. During the period of 2004 to 2008, there have been 32 exceedances of 1-hr and 2 exceedances of 24-hr AAAQO. In 2008 alone, there were no exceedances reported based on SO_2 monitoring. Trends of SO_2 as monthly averages from January 2001 to December 2008 (units in ppb) demonstrate a significant upward trend for the stations Fort McKay, Millennium, and Syncrude UE1. It is also important to note that the majority of the exceedances were reported from the Mannix station (22 of the 34) which has not demonstrated an increasing trend.

Sulphur Dioxide Monitoring (units in ppb)



Data taken from CASA – www.casadata.org

	Data Points (months)	Seasonal Kendall Test H0: No Trend	p-value	Sulphur Dioxide Results
WBEA - Albian Mine Site	87	H1: Downward Trend	0.58	Not Significant
WBEA - Athabasca Valley	95	H1: Downward Trend	0.04	Significant Downward Trend
WBEA - Buffalo Viewpoint	94	H1: Downward Trend	0.13	Not Significant
WBEA - Fort Chipewyan	95	H1: Downward Trend	0.01	Significant Downward Trend
WBEA - Fort McKay	96	H1: Upward Trend	0.07	Significant Upward Trend
WBEA - Lower Camp	90	H1: Downward Trend	0.23	Not Significant
WBEA - Mannix	96	H1: Downward Trend	0.60	Not Significant
WBEA - Mildred Lake	96	H1: Downward Trend	0.04	Significant Downward Trend
WBEA - Millennium	72	H1: Upward Trend	0.00	Significant Upward Trend
WBEA - Patricia McInnes	96	H1: Downward Trend	0.01	Significant Downward Trend
WBEA - Syncrude UE1	76	H1: Upward Trend	0.09	Significant Upward Trend

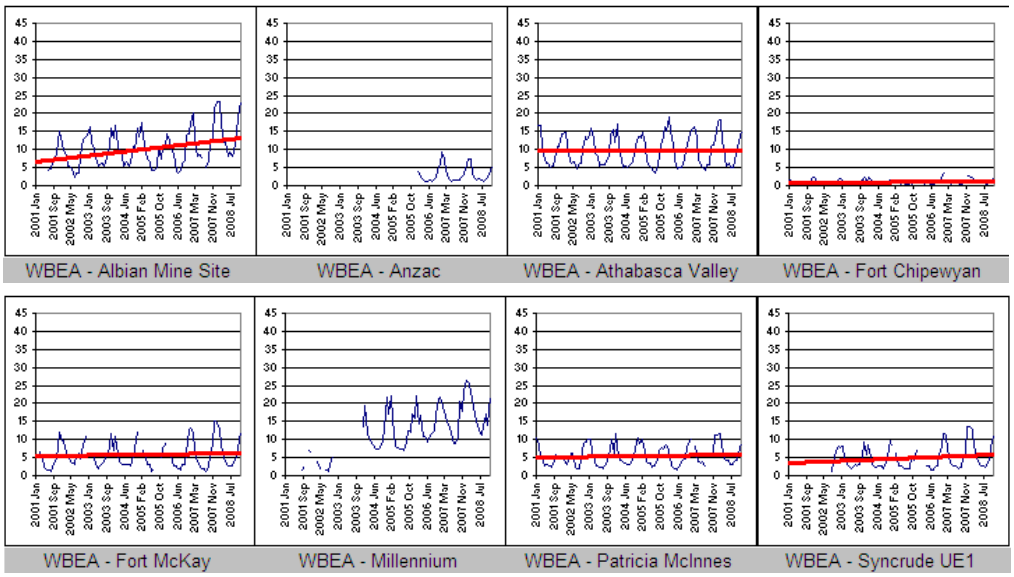
Data taken from CASA – www.casadata.org

Issue: Nitrogen Dioxide Air Quality

Reference: EIA Appendix 3, Appendix 3-7, Existing Air Quality and Meteorology, Section 2.1 Continuous Ambient Monitoring, 2.1.2 Nitrogen Dioxide Concentrations, pg 11

Concern: Unlike SO_2, the summary of maximums for NO_2 was not as elevated, with only one occurrence of ambient 1-hr exceedance between the period of 2004 to 2008 (of which occurred in 2008). It is also important to identify trends of NO_2, as a result data has been presented as monthly averages from January 2001 to December 2008 (units in ppb). Based on the data reviewed, the WBEA stations Albian Mine Site, Patricia McInnes, and Syncrude UE1 demonstrate a significant upward trend.

Nitrogen Dioxide Monitoring (units in ppb)



Data taken from CASA – www.casadata.org

	Data Points (months)	Seasonal Kendall Test H0: No Trend	p-value	Nitrogen Dioxide Results
WBEA - Albian Mine Site	89	H1: Upward Trend	0	Significant Upward Trend
WBEA - Athabasca Valley	96	H1: Downward Trend	0.653	Not Significant
WBEA - Fort Chipewyan	92	H1: Downward Trend	0.982	Not Significant
WBEA - Fort McKay	91	H1: Downward Trend	0.85	Not Significant
WBEA - Patricia McInnes	94	H1: Upward Trend	0.002	Significant Upward Trend
WBEA - Syncrude UE1	73	H1: Upward Trend	0	Significant Upward Trend

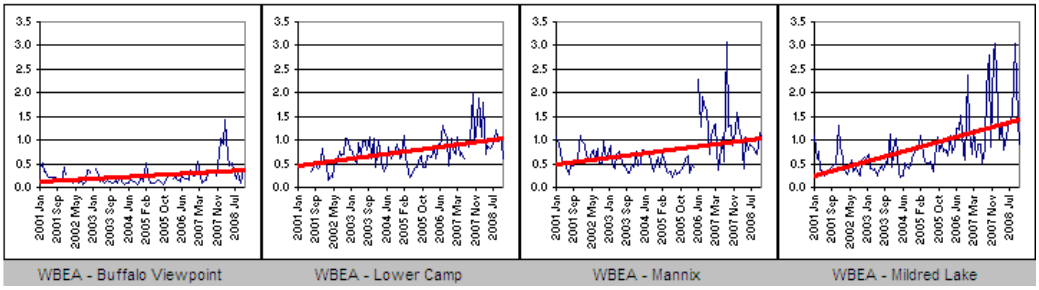
Data taken from CASA – www.casadata.org

Issue: Hydrogen Sulphide Air Quality

Reference: EIA Appendix 3, Appendix 3-7, Existing Air Quality and Meteorology, Section 2.1 Continuous Ambient Monitoring, 2.1.3 Hydrogen Sulphide Concentrations, pg 15

Concern: Hydrogen Sulphide has demonstrated higher readings in the region and has far more exceedances above the AAAQO than any other parameter. Between the periods of 2004 to 2008 there have been 957 1-hr exceedances and 184 24-hr exceedances (of which 417 of these occurred in 2008). With these numbers of exceedances it is very important to identify trends of H_2S, and as a result data has been presented as monthly averages from January 2001 to December 2008 (units in ppb). Based on the data reviewed, the WBEA stations Buffalo Viewpoint, Lower Camp, Mannix, and Mildred Lake all demonstrate a significant upward trend with the H_2S monitoring. **Are there are any plans to address these observed increases?**

Hydrogen Sulphide Monitoring (units in ppb)



Data taken from CASA – www.casadata.org

	Data Points (months)	Seasonal Kendall Test H0: No Trend	p-value	Hydrogen Sulphide Results
WBEA - Buffalo Viewpoint	93	H1: Upward Trend	0.01	Significant Upward Trend
WBEA - Lower Camp	89	H1: Upward Trend	0	Significant Upward Trend
WBEA - Mannix	95	H1: Upward Trend	0.034	Significant Upward Trend
WBEA - Mildred Lake	96	H1: Upward Trend	0	Significant Upward Trend

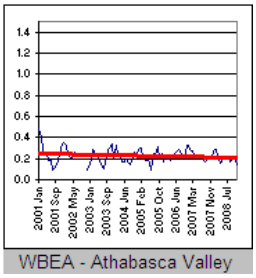
Data taken from CASA – www.casadata.org

Issue: Carbon Monoxide Air Quality

Reference: EIA Appendix 3, Appendix 3-7, Existing Air Quality and Meteorology, Section 2.1 Continuous Ambient Monitoring, 2.1.4 Carbon Monoxide Concentrations, pg 20

Comment: Carbon Monoxide is only monitored at one station in the region, of which there have been no exceedances above the AAAQO over the past several years. In addition the trend of CO, presented as monthly averages from January 2001 to December 2008 (units in ppm) has shown a significant downward trend.

Carbon Monoxide (units in ppm)



	Data Points (months)	Seasonal Kendall Test H0: No Trend	p-value	Carbon Monoxide Results
WBEA - Athabasca Valley	91	H1: Downward Trend	0.072	Significant Downward Trend

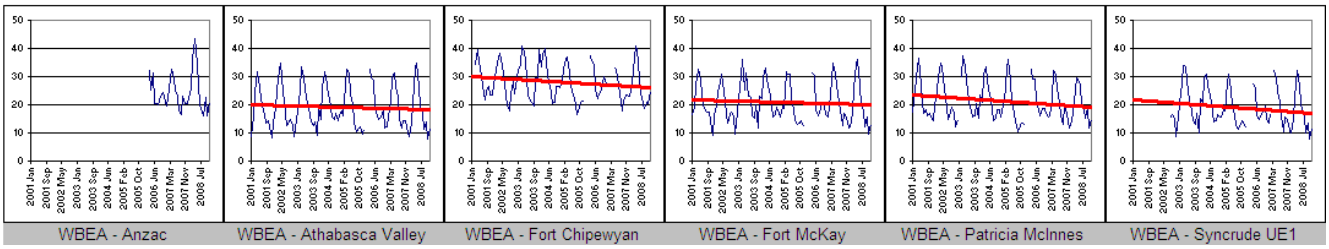
Data taken from CASA – www.casadata.org

Issue: Ozone Air Quality

Reference: EIA Appendix 3, Appendix 3-7, Existing Air Quality and Meteorology, Section 2.1 Continuous Ambient Monitoring, 2.1.5 Ozone Concentrations, pg 23

Comment: The ozone review has highlighted three 1-hr exceedance of the AAAQO between the period of 2004 to 2008 (of which none occurred in 2008). Based on concern over ground level ozone levels it is important to identify trends of O_3 as monthly averages from January 2001 to December 2008 (units in ppb). Based on the data reviewed the WBEA stations Fort Chipewyan, Patricia McInnes, and Syncrude UE1 all demonstrate a significant downward trend, with no upward trends noted.

Ozone Monitoring (units in ppb)



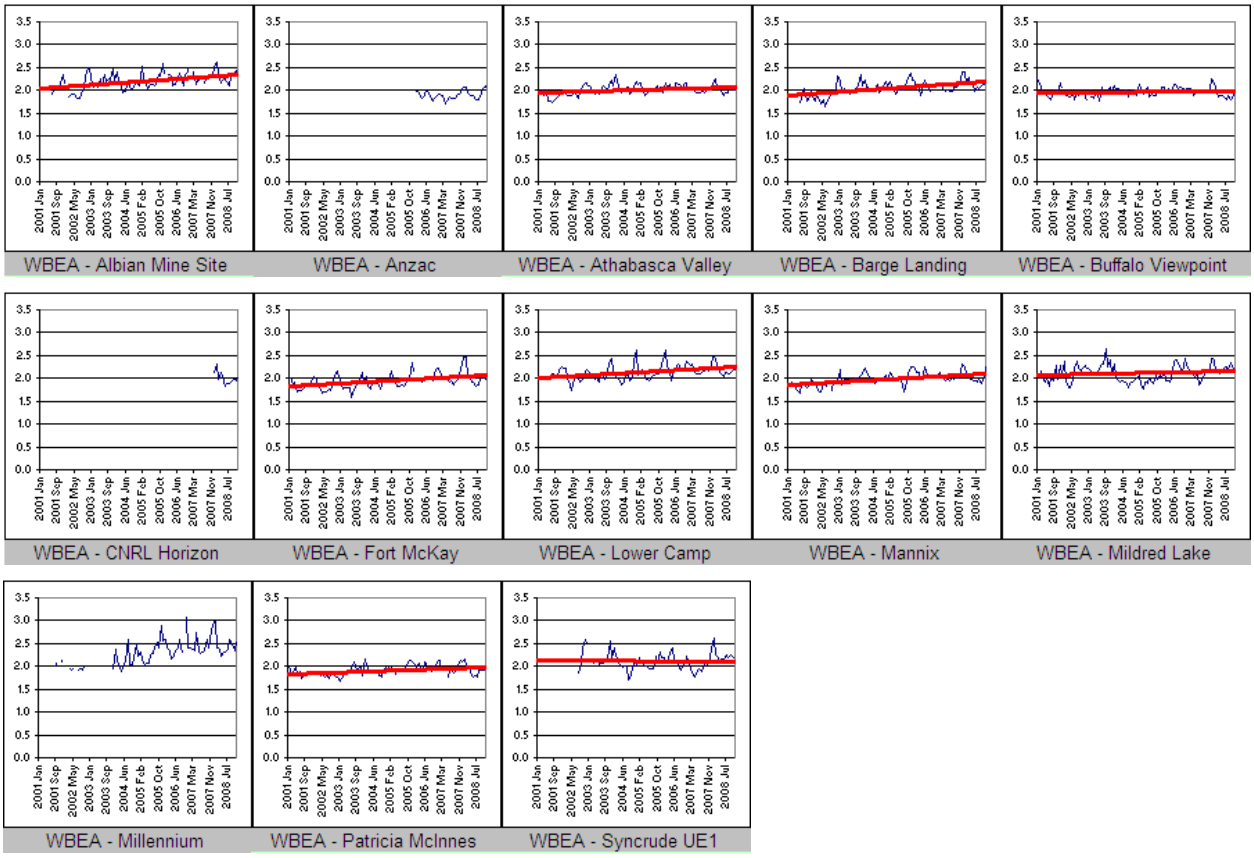
Data taken from CASA – www.casadata.org

	Data Points (months)	Seasonal Kendall Test H0: No Trend	p-value	Ozone Result
WBEA - Athabasca Valley	94	H1: Downward Trend	0.794	Not Significant
WBEA - Fort Chipewyan	91	H1: Downward Trend	0.072	Significant Downward Trend
WBEA - Fort McKay	93	H1: Downward Trend	0.401	Not Significant
WBEA - Patricia McInnes	93	H1: Downward Trend	0.029	Significant Downward Trend
WBEA - Syncrude UE1	72	H1: Downward Trend	0.007	Significant Downward Trend

Data taken from CASA – www.casadata.org

Issue: Total Hydrocarbon Quality
Reference: EIA Appendix 3, Appendix 3-7, Existing Air Quality and Meteorology, Section 2.1 Continuous Ambient Monitoring, 2.1.7 Total Hydrocarbon Concentrations, pg 35
Concern: There are no current AAAQO to compare ambient THC readings against rather a comparison of trends to highlight any potential issues. As such the trends of THC have shown significant upward trends for all but three stations using the monthly averages from January 2001 to December 2008 (units in ppm). With several of the stations demonstrating a significant upward trend in ambient THC, are there any plans to investigate possible reduction measures to limit or stop the increasing trend?

Total Hydrocarbon Monitoring (units in ppm)



Data taken from CASA – www.casadata.org

	Data Points (months)	Seasonal Kendall Test H0: No Trend	Significant	Total Hydrocarbon Result
WBEA - Albian Mine Site	86	H1: Upward Trend	0.00	Significant Upward Trend
WBEA - Athabasca Valley	95	H1: Upward Trend	0.01	Significant Upward Trend
WBEA - Barge Landing	87	H1: Upward Trend	0.00	Significant Upward Trend
WBEA - Buffalo Viewpoint	94	H1: Upward Trend	0.19	Not Significant
WBEA - Fort McKay	94	H1: Upward Trend	0.00	Significant Upward Trend
WBEA - Lower Camp	89	H1: Upward Trend	0.00	Significant Upward Trend
WBEA - Mannix	93	H1: Upward Trend	0.00	Significant Upward Trend
WBEA - Mildred Lake	95	H1: Upward Trend	0.25	Not Significant
WBEA - Patricia McInnes	94	H1: Upward Trend	0.00	Significant Upward Trend
WBEA - Syncrude UE1	75	H1: Upward Trend	0.40	Not Significant

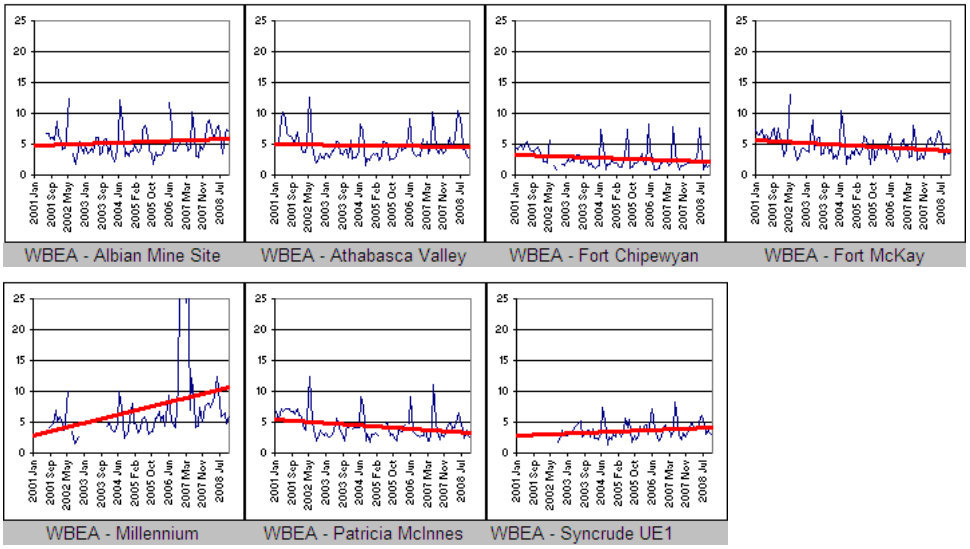
Data taken from CASA – www.casadata.org

Issue: Particulate Matter Quality

Reference: EIA Appendix 3, Appendix 3-7, Existing Air Quality and Meteorology, Section 2.1 Continuous Ambient Monitoring, 2.1.8 Particulate Matter Concentrations, pg 41

Concern: This section compares the data to the CWS of $PM_{2.5}$; however it can be compared against the AAAQO instead. As such there have been a total of 33 exceedances of the 24-hr AAAQO for $PM_{2.5}$ over the last 5 years, of which only one occurred in 2008. The trends of $PM_{2.5}$ vary with each station analyzed based on the monthly averages from January 2001 to December 2008 (units in $\mu g/m^3$). Of the WBEA stations reviewed two had no significant trend, three had significant downward trends, and two stations had significant upward trends (specifically the Millennium and Syncrude UE1 stations). As the trends are diverse for this parameter are there any contingency plans in the event $PM_{2.5}$ levels begin showing more upward tendencies?

Particulate Matter ($PM_{2.5}$) Monitoring (units in ug/m3)



Data taken from CASA – www.casadata.org

	Data Points (months)	Seasonal Kendall Test H0: No Trend	p-value	Particulate Matter Results
WBEA - Albian Mine Site	86	H1: Downward Trend	0.90	Not Significant
WBEA - Athabasca Valley	94	H1: Downward Trend	0.77	Not Significant
WBEA - Fort Chipewyan	93	H1: Downward Trend	0.00	Significant Downward Trend
WBEA - Fort McKay	95	H1: Downward Trend	0.02	Significant Downward Trend
WBEA - Millennium	74	H1: Upward Trend	0.00	Significant Upward Trend
WBEA - Patricia McInnes	92	H1: Downward Trend	0.02	Significant Downward Trend
WBEA - Syncrude UE1	76	H1: Upward Trend	0.01	Significant Upward Trend

Data taken from CASA – www.casadata.org