Establishing a World Class Public Information and Reporting System for Ecosystems in the Oil Sands Region – Report

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Oil Sands Research and Information Network

OSRIN is a university-based, independent organization that compiles, interprets and analyses available knowledge about returning landscapes and water impacted by oil sands mining to a natural state and gets that knowledge into the hands of those who can use it to drive breakthrough improvements in reclamation regulations and practices. OSRIN is a project of the University of Alberta's School of Energy and the Environment (SEE). OSRIN was launched with a start-up grant of $4.5 million from Alberta Environment and a $250,000 grant from the Canada School of Energy and Environment Ltd.

OSRIN provides:

- **Governments** with the independent, objective, credible information and analysis required to put appropriate regulatory and policy frameworks in place
- **Media, opinion leaders and the general public** with the facts about oil sands development, its environmental and social impacts, and landscape/water reclamation activities – so that public dialogue and policy is informed by solid evidence
- **Industry** with ready access to an integrated view of research that will help them make and execute reclamation plans – a view that crosses disciplines and organizational boundaries

OSRIN recognizes that much research has been done in these areas by a variety of players over 40 years of oil sands development. OSRIN synthesizes this collective knowledge and presents it in a form that allows others to use it to solve pressing problems. Where we identify knowledge gaps, we seek research partners to help fill them.

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Copies of this report may be obtained from OSRIN at osrin@ualberta.ca or through the OSRIN website at http://www.osrin.ualberta.ca or directly from the University of Alberta's Education & Research Archive at http://hdl.handle.net/10402/era.17507.

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REPORT SUMMARY

This report presents a vision for a comprehensive and effective Public Information and Reporting System for Ecosystem Effects in the Oil Sands Region that is relevant, credible, durable, transparent, and robust. The report describes the key Principles and Elements of an information and reporting system that would provide Albertan's and the World with assurance that ecosystem effects due to development in the Wood Buffalo region are reported and evaluated and, along with socio-economic information, support decision-making and responsible management of the land, air and water. The report describes two Scenarios to improve the current system.

This report was developed through an intensive six month (January to June, 2010) structured process called the Challenge Dialogue System where we addressed the question of "What Constitutes an Adequate and Effective Public Information and Reporting System for Ecosystems in the Oil Sands Region?" This process involved 70 people drawn from industry, government (all levels), NGOs, First Nations, academia and the public. A one-day workshop in June 2010, attended by 25 people from government, industry, NGOs and staff from the four major monitoring programs in the Wood Buffalo Region, further refined the concepts arising from the written feedback.

The Principles for an effective information and reporting system are:

- Relevant (responsive, addresses key objectives, supports decisions)
- Credible (science-based, consistent methodology, standardized reporting, verifiable, independent and objective, collaborative)
- Understandable (increases public awareness, causal relations understood)
- Transparent (publicly available data, methodology and reports, timely reporting)
- Robust (durable, continuously-improving)

Two scenarios were developed to provide advice to improving the current information and report system for ecosystem effects in the oil sands region. These scenarios are:

- An Enhanced Information and Reporting System developed from the current assemblage of monitoring and reporting programs; and
- A World Class Information and Reporting System that incorporates or replaces the current system.

The Key Criteria for a World Class Information and Reporting System are:

- Independence
- Responsiveness
- Administrative and operational integration
- Transparent and collaborative governance structure
- Stable funding

- Integration across media
- Ease of access to data and information
- Excellence in reporting and communication
- Understanding of causal relationships
- Complex science-based information is understandable by all audiences
- Operational excellence
- Continuous improvement

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The Dialogue was assisted by the Advisory Members of the Organizing Team comprised of Satya Das, Cambridge Strategies Inc.; Calvin Duane, Canadian Natural Resources Ltd.; Simon Dyer, Pembina Institute; Fred Kuzmic, Shell Albian Sands; Albert Poulette, Alberta Environment; and Lisa Schaldemose, Fort McKay Industrial Relations Corporation.

The Dialogue was facilitated by Douglas James, Congruent Strategies and Terje Vold, Terje Vold & Associates Consulting Ltd.

OSRIN, the Organizing Team and the consultants are grateful for all of the constructive input received from people who participated in one or more parts of the Challenge Dialogue process.

1 INTRODUCTION

This report summarizes the results of an intensive six month (January to June, 2010) structured process called the Challenge Dialogue System[1] where we addressed the question of "What Constitutes an Adequate and Effective Public Information and Reporting System for Ecosystems in the Oil Sands Region?" This process involved 70 people drawn from industry, government (all levels), NGOs, First Nations, academia and the public.

OSRIN was seeking to establish through the Challenge Dialogue, and through a separate independent survey of Albertans by Chapman and Das (2010), the key principles and elements of an information and reporting system that can provide the public with assurance that potential ecosystem effects of oil sands development are known and, with such knowledge can be used to inform future management action.

For further information on the four major environmental effects monitoring programs in the Wood Buffalo Region (Alberta Biodiversity Monitoring Institute (ABMI), Regional Aquatic Monitoring Program (RAMP), Wood Buffalo Environmental Association (WBEA) and Cumulative Environmental Management Association (CEMA)) see the OSRIN report by Lott and Jones (2010).

1.1 The Challenge

Public scrutiny of the effects oil sands development on the environment has steadily increased over the past several years, including several recent high-profile media events and publications.

Many people are concerned that oil sands development is having significant negative impacts on the ecosystem. They are interested in knowing what impacts are occurring, what impacts were expected and what actions have been taken or are planned to avoid, mitigate or minimize both expected and unexpected impacts over time. There are various opinions held by the public. Some individuals or organizations believe that the environmental impacts from oil sands development are unacceptable, either in absolute terms or relative to derived economic and social benefits. Others believe that development of the oil sands resource is acceptable providing the impacts of oil sands development are minimized while the resource is being extracted and the end state of the land following reclamation is ecologically viable.

The public debate on the question of potential ecosystem effects related to oil sands development has been neither balanced nor informed. While effects from oil sands mining and other operations are inevitable, the relevant question is "How significant are the impacts and can the land can be returned to a productive state?" There is a wide variation in opinion on the significance and duration of the impacts including both what constitutes a significant impact and what constitutes an appropriate management responses to those impacts. Moreover, because

[1] This report follows in part an approach, structure and tools developed by the *Innovation Expedition Inc*. and its *Challenge Dialogue System*^{TM} — a disciplined process that engages diverse groups on discovering collaborative and innovative solutions to complex challenges. www.innovation.expedition.com

many of the hydrocarbons and other chemicals released from oil sands development are potentially harmful to ecosystems and human health, it is vitally important to understand the degree to which these constituents are entering the ecosystem beyond naturally occurring levels.

Environmental concerns have led to significant and increasing public pressure to reduce or restrict the development of the Alberta oil sands. Effectively addressing these concerns is required to sustain the social license for Alberta's oil sands industry to operate, access markets, and access capital to invest in oil sands.

Ultimately, these concerns can be addressed only by having a trusted source transparently and effectively providing credible information to all interested parties.

The oil sands industry and the Alberta government, along with other participants, currently maintain or support many monitoring programs intended to address questions about ecosystem effects that, potentially, should be able resolve confusion regarding the effects of oil sands development (Lott and Jones 2010).

In spite of these monitoring programs, there is no consensus on whether or not significant ecological effects are occurring due to oil sands development. This may be because the information from existing monitoring programs is not being effectively evaluated and reported, or because the monitoring systems in place do not provide sufficient information on ecosystems to support a credible assessment of impacts. There are a variety of reasons for this. Some people believe that the scientific studies and performance measures to date are adequate but that access to and transparency of that information has not been adequate. Others believe that the scientific studies available have not been adequately used or understood to inform the debate. Some people simply do not believe the current sources of information. Others also say that our current understanding is incomplete because most historical "scientific studies" were not designed to assess ecosystem effects. In addition, ecosystem monitoring is not simple – the potential for effects on ecosystems is related to the location, magnitude, duration, frequency, timing and contaminant concentration in releases. Some values monitored change depending on the scale of observation and, consequently, issues of comparability arise when moving from local effects to lease-specific impact assessments and finally to regional scale and cumulative impact assessments. In general, historical studies are not regional in scale and select local impacts need to be reported to capture locally significant impacts such as odors.

It is Alberta's responsibility to manage the oil sands resource and its development by industry in a responsible manner that strikes a balance between social, economic and environmental considerations so that negative ecosystem effects are avoided and/or mitigated where possible and practical to do so. Environmental evaluations need to be in context with social and economic impact and consequently a frame of reference is needed against which it is possible to compare the results of monitoring.

In light of the controversy, it is clear that improvements in the current monitoring and reporting system are urgently required. It all comes down to ensuring that the public has confidence in the ecosystem effects monitoring system.

It is against this backdrop that a group of 70 individuals from across industry, academia, government (provincial, federal and municipal), First Nations, and NGOs worked together over a period of six months to:

> *Describe the key principles and elements of an information and reporting system that would provide Albertan's and the World with assurance that ecosystem effects due to development in the Wood Buffalo region are reported and evaluated and, along with socio-economic information, support decision-making and responsible management of the land, air and water.*

1.2 Structure of the Report

The report is organized as follows:

- The body of the report describes the key Principles and Elements of an information and reporting system that would provide Albertan's and the World with assurance that ecosystem effects due to development in the Wood Buffalo region are reported and evaluated and, along with socio-economic information, support decision-making and responsible management of the land, air and water. The report also provides two Scenarios to improve the current system.
- Appendices 1 to 5 provide supporting information related to the body of the report:
  - Appendix 1 – Guiding Principles
  - Appendix 2 – Partial List of Monitoring Programs
  - Appendix 3 – Current Status of Monitoring and Reporting Programs
  - Appendix 4 – Draft Logic Model
  - Appendix 5 – Mapping of Key Findings

The Challenge Dialogue process is disciplined process that engages diverse groups on discovering collaborative and innovative solutions to complex challenges. A Challenge Dialogue typically operates over several months, with the bulk of the work being done electronically with the participants via the issuance of an initial Challenge Paper which is then commented on. The synthesized comments are used to create one or more Progress Reports, the process being repeated iteratively as the Challenge evolves. Finally, a face-to-face Workshop is held to work in a focused way on the remaining outstanding issues.

The output documents from this Challenge Dialogue are provided in the extended version of the report[2], and include:

- the original Challenge Paper that was sent out to interested parties to to introduce the key problem, provide context and the current understanding, and to seek feedback.
- the synthesis of the feedback received on the Challenge paper.
- the Progress Report which incorporated the feedback into an updated Challenge paper for further comment.
- the Workshop Workbook, based on the Progress Report and feedback received, that was given to Workshop participants as background material.
- the Workshop Summary Report that brought together all the input gathered at the Workshop.

2 KEY PRINCIPLES

Effective environmental information and reporting systems are developed in context of the circumstances of the region to be monitored, the purpose of the outputs of system and the stakeholders to the process. Typically, environmental monitoring and reporting is undertaken to:

- Provide information to the public to assure them that any unanticipated effects on health or the environment from industrial development are known and understood;
- Provide information to regulators to assist in managing individual industrial developments and regional environmental protection;
- Provide information to government and industry to allow them to continuously improve their human health and environmental protection programs.

These contextual preconditions were explored in detail for Alberta (Appendix 1) and provide the background for developing an effective information and reporting system specifically for the oil sands region.

With this context in mind, five key principles were developed to ensure that ANY public information and reporting system will be credible and believable by a wide audience. Key elements of the desired information and monitoring system are described under each principle.

It is through the lens of these principles and elements that we developed scenarios for an effective Information and Reporting System for ecosystem effects in the oil sands region.

[2] D.R. James and T. Vold, 2010. *Establishing a World Class Public Information and Reporting System for Ecosystems in the Oil Sands Region – Report and Appendices*. Oil Sands Research and Information Network, University of Alberta, School of Energy and the Environment, Edmonton, Alberta. OSRIN Report No. TR-5.

2.1 Principle #1: Relevant

The information and reporting system needs to address key objectives (e.g., as expressed from a variety of sources including provincial strategies, regulations and reporting requirements for industry; regional land use plans; local communities and First Nations).

The information and reporting system must support a business management decision process and be responsive to the needs of decision-makers so that the information and reporting is used to make timely and well informed decisions.

Reporting should capture both transient events and trends to address both the long- and short-term needs of the various stakeholders.

The information and reporting system needs to support local, regional and national assessment and reporting of ecosystem effects.

2.2 Principle #2: Credible

Information and reporting about ecosystem effects in the oil sands region needs to be science-based and employ recognized best practices, with appropriate quality assurance measures applied, and be subject to periodic peer review.

Information, including monitoring, needs to be reviewed and verified. Information gathering, analysis and reporting should be standardized with consideration that a certified framework such as ISO or CSA be used or adapted where appropriate.

A collaborative structure providing oversight involving government, industry, First Nations, academia and non-government organizations will enhance credibility of an information and reporting system.

2.3 Principle #3: Understandable

Complex science-based information needs to be interpretable, and interpreted, so that the public and decision-makers understand its meaning (e.g., using "plain language" rather than scientific terms; using a risk-based approach where the likelihood and consequences of adverse environmental impacts are considered). This results in the need for multiple information formats including raw data, science-based analyses and plain language analyses.

The causal relationships of ecosystem effects need to be understood so that information and reporting is directed to appropriate decision-makers and to avoid misinforming the public (e.g., not all impacts in the oil sands region are due to oil sands development – other sources of effects may be causing the impacts). This will involve developing linkages between the information and reporting system and existing and ongoing research into causal relationships.

2.4 Principle #4: Transparent

The public information and reporting system must be transparent with respect to data collection methods, data collected, and models used for evaluation. Data should be released early as "best

available" information with provisos in context with its intended application, and as "final" when appropriate.

All information and reporting needs to be made readily accessible at little or no cost to the public.

A fully integrated *State of the Environment Report for the Oil Sands Region* synthesis report should be published periodically (e.g., complete cycle for all sectors every 3 to 5 years, with specific sectors reporting each year on a rotation). A collaborative structure led by the Government of Alberta (such as described above) that oversees the development of the report as well as peer review to ensure the report is based on sound science will enhance its credibility. The report should document ecosystem changes and management efforts to avoid, mitigate or lessen impacts. It will be necessary to establish the region boundary, or otherwise make it clear the intended scope of the report.

2.5 Principle #5: Robust

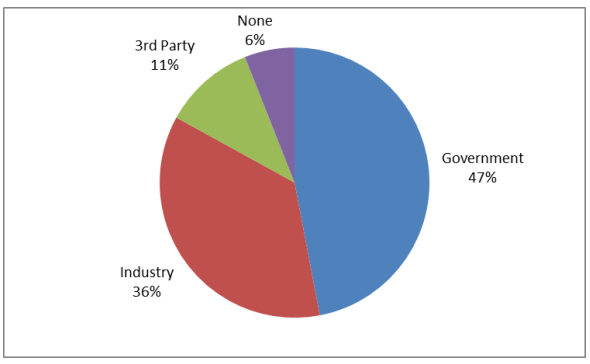
The information and reporting system should be independent with stable, long-term funding.

A high quality information and reporting system will employ the principles of continuous improvement to ensure that it remains relevant, credible, understandable and transparent. It is important that any improvements made do not unduly compromise the ability to compare current data to baselines (or even year to year) as this would affect the ability to document change over time. The system itself must also be flexible to be able to address the key objectives that can change over time.

3 CURRENT STATUS

The current reporting and information system is comprised of several monitoring and reporting programs that, for historical reasons, are neither comprehensive nor integrated. An outline of the current system is given in Appendix 2 and Appendix 3. The current slate of programs were developed over time, are not uniform in application or extent of monitoring, are variable in the degree of access to data, are not integrated or collaborative with each other, and have different funding and governance structures.

These deficiencies are understood by most participants in the existing monitoring and reporting system and some efforts have begun to bridge the problems. Two government initiatives are being developed, one by Alberta Environment (IMERF) and another by the Oil Sands Secretariat, which intend to address many of the issues regarding access, reporting and decision-making based on monitoring data. Some of the programs (RAMP, CEMA) are also looking to improve both transparency and the availability of data.



These efforts are both timely and necessary. According to the June 2010 OSRIN/Cambridge Strategies survey of Albertans' values regarding oil sands development, monitoring of ecological impacts was among the three most important factors in continued public acceptance of

development (Chapman and Das 2010). In the 2010 survey 47% of participants believed the government was doing the monitoring, 36% believed industry was responsible and 11% were of the view that independent third parties were doing the ecological monitoring. Only 6% felt there was no ecological monitoring.

4 FUNDAMENTAL REQUIREMENTS FOR AN EFFECTIVE INFORMATION AND REPORTING SYSTEM

To be relevant and credible, any information and reporting system for the oil sands region will address the Key Principles and, *at a minimum,* will:

- Support local, regional and national assessment and reporting of ecosystem effects in the entire oil sands region.
- Address key objectives as expressed from a variety of sources including provincial strategies, regulations and reporting requirements for industry, regional land use plans, local communities and First Nations in the oil sands region.
- Support a business management decision process and be responsive to the needs of decision-makers so that the information and reporting is used to make timely and well informed decisions. It can do this by supporting both regulatory requirements and non-regulatory best practices, and being timely and responsive to the users of the information.
- Capture both transient events and trends to address both the long and short term needs of the various stakeholders. To do this, the system must:
    - be designed to support the need for both 'corporate' memory and public confidence in a reliable system;
    - accommodate changes implemented over time, to provide confidence in and continuity for the stakeholders to the system; and
    - ensure that slowly emerging events are reported accurately - there is benefit in cumulative effects monitoring as you learn things not expected that evolve over time.
- Be science-based and employ recognized best practices with appropriate quality assurance measures and be subject to periodic peer review. To address public perceptions of credibility, it is important that both the monitoring and reporting functions are at arm's length from and, ideally, independent of both program funders and users of the data including companies, regulators, government departments and other stakeholders. In this way, the claims of stakeholders, government and industry regarding environmental performance can be evaluated against credible data.

5 IMPROVING THE CURRENT SYSTEM

Two scenarios were developed to describe what it will take to transition the current Information and Reporting System into either an enhanced system or a world class system for the oil sands region.

5.1 Scenario I: Enhanced Information and Reporting System

Scenario I describes an Enhanced Information and Reporting System that addresses much of the information and reporting needs of the various audiences without substantially increasing the scope or expenditures of the existing monitoring system. Scenario I is viewed as an interim solution to improving the current system.

Based on the principles developed during the Dialogue, an Enhanced Information and Reporting System would build upon the existing system to achieve the objectives outlined below.

5.1.1 *Greater Integration*

The Enhanced Information and Reporting System is more integrated than the current system. Integration addresses the functions of data collection, evaluation, synthesis, and communication. It would also be useful to integrate reporting, funding, continuous improvement, administration and governance.

Integration could be achieved by instituting a common reporting structure. This could be done by merging the existing programs or establishing a single overarching entity that manages individual media-based monitoring programs but, in either case, operating them under a common collaborative governance mechanism. Oversight and a clear mandate will be needed to integrate and amalgamate when it makes sense to do so: the current programs are a disparate assemblage with wide variation of monitoring, data analysis, location, operational form, reporting, management, governance and mandate - it will be necessary to address these disparities to provide a comprehensive and coherent reporting system.

A collaborative governance mechanism will be established that includes government, industry, First Nations, academia and non-government organizations. The governance mechanism should not be involved in detail or design of the system to ensure objective science. Ideally, to ensure wide-spread credibility, the governance mechanism will be independent of, but responsive to, the stakeholders and funders.

It is essential to ensure critical separations are made between data providers (monitoring) and the users of data (reporting) in the integrated system to ensure independence.

5.1.2 *Reliable, Stable Funding*

Stable, long term committed funding will raise the credibility of the Enhanced Information and Reporting System, allow for forward planning and support better decision making. Funding needs to be at the level necessary to achieve the objectives of the program (and accommodate the changes that are necessary over time). There is no intent to increase the amount of monitoring in this scenario other than as required by regulation.

Potential options to achieve stable funding include a mandatory levy on industrial activity or direct provincial funding. The allocation of funding would likely be for core monitoring paid for by all and site-specific monitoring paid for by the entities responsible for specific sites (however the site-specific monitoring information is also provided to the Enhanced Information and Reporting System to ensure regional reporting is comprehensive).

It is important to recognize that industry monitoring costs are eligible expenses for royalty calculation purposes (i.e., they reduce royalties payable), which means that the public is ultimately paying for a portion of the costs when industry pays for monitoring. One implication is that the amount of monitoring and reporting can be established at the level commensurate with the public's need for assurance and willingness to pay based on the perceived need.

Routine program reviews should be conducted to ensure that the funding is efficiently and effectively deployed.

5.1.3 *Improved Access to and Understanding of Data*

The Enhanced Information and Reporting System improves both access to the data and understanding of the implications of the data.

The Enhanced Information and Reporting System will be more transparent with respect to data collection methods, data collected, and the models used for evaluation. This will require disclosure of information and interpretation methods that is both understandable and provides context to stakeholders. Moreover, the information will be readily accessible at little or no cost to the public (for some existing programs there are additional steps required to gain access to data; it is also not easy to get access to data submitted to government as part of regulatory requirements).

Improving access will most likely be best achieved by self-service access to data, which will also help address concerns regarding the costs of meeting data requests. In addition, an ombudsman for data requests could be considered to facilitate access prior to the establishment of a more effective mechanism.

5.1.4 *Improved Reporting and Communication*

Currently, it is often difficult to access the information being collected due to issues of confidentiality or proprietary ownership.

An effective way to significantly improve reporting and communication would be to regularly publish a fully integrated *State of the Environment Report for the Oil Sands Region* synthesis document for all monitoring systems (no such document is currently available). This report can be the main integrating tool for the various monitoring programs across all media (air, water and groundwater). The report should document ecosystem changes and management efforts to avoid, mitigate or lessen impacts. A current index of environmental integrity similar to Alberta's Air

Quality Index[3] (e.g., good, fair and poor) should be reported along with explanatory text for context. The report should include environmental forecasting where trends show some indicators are improving, some with no significant change, and some deteriorating.

The report's credibility will be enhanced by a collaborative governance structure that oversees the development of the report and a peer review process that ensures the report is based on sound science.

Due to the magnitude of the task, it may be necessary to cycle through all the media every three to five years, with specific media reporting each year on a rotation.

5.1.5 *Causal Relationships*

The causal relationships of ecosystem effects need to be better understood to avoid misinforming the public (not all impacts in the oil sands region are necessarily due to oil sands development and other sources of effects may be causing the impacts) and so that important information is directed to appropriate decision-makers. This will require establishing a scientific investigative function. As with the monitoring and reporting functions, the investigative/interpretive science function responsible for determining cause-effect evaluations should operate independently.

Overall, it is critical to recognize that providing context is as important as enhanced interpretation – the data, information and reports need to be interpretable by a wide audience.

5.2 Scenario II: World Class Information and Reporting System

Scenario II addresses what it will take to create a World Class Information and Reporting System in the oil sands region. In addition to implementing all attributes of the Enhanced Information and Reporting System (above), this will be achieved by meeting the criteria outlined below.

5.2.1 *Comprehensive System*

The World Class Information and Reporting System consists of:

- Monitoring infrastructure that allows for collection and analysis of environmental samples at the right locations and at the right frequency (this will include stationary and mobile infrastructure);
- Technical support infrastructure that allows for the analysis and interpretation of the sampling data;
- Reporting infrastructure that takes the data and makes them available in real time and in useable formats for stakeholders (the form of data will likely vary depending on the user); and
- Governance structure that is transparent and provides assurance to the stakeholders that the results can be trusted.

[3] See WBEA http://wbea.org/content/view/29/198/

5.2.2 *Independent and Responsive*

Independence is achieved by establishing an independent organization such as a not-for-profit company or society that is at arm's-length from both industry and government and with both federal and provincial regulatory support requiring participation by industry. While being independent, the World Class Information and Reporting System will be responsive through the governance structure.

5.2.3 *Administratively and Operationally Integrated*

The World Class Information and Reporting System is administratively and operationally integrated. Integration is achieved by mandating and empowering this single organization to collect, interpret and report environmental data for the oil sands region. The physical extent of the "oil sands region" is clearly defined and considers the effects of all industrial and urban development, not just oil sands development.

The World Class Information and Reporting System has the mandate to:

- gather environmental data;
- disseminate environmental data and interpretations of the data;
- release information and discuss results with stakeholders and media pursuant to internal governance guidelines;
- inform regulators, industry and other stakeholders when human health or environmental thresholds are reached;
- investigate and test new monitoring and reporting methods for potential incorporation into the System;
- evaluate and respond to claims of human health or environmental effects by stakeholders; and
- educate stakeholders on environmental monitoring and the results of the program.

A less effective (interim) solution to integration could be an independent organization charged with integrating the information collected by existing monitoring programs (e.g., from ABMI, WBEA, RAMP, CEMA).

5.2.4 *Transparent and Collaborative Governance Structure*

The governance structure is transparent and provides assurance to the stakeholders that the results can be trusted. The governance structure will be a collaborative mechanism that ensures all relevant parties have a voice in program design (including government, industry, First Nations, academia and non-government organizations). The governance structure will include:

- arms-length peer-review of methods and results that is made public and that requires the monitoring program provide public responses to the review;

- carefully evaluates the impacts of changes to, additions to or deletions from the System goals and functions to identify the impacts of the change on the mandate and scientific credibility of the organization;
- clearly separates the monitoring and reporting function from the decision-making and rule-setting functions, but at the same time is responsive to the needs of the decision-makers;
- includes mandatory ongoing training of personnel; and
- includes mandatory ongoing maintenance and updating of infrastructure.

5.2.5 *Reliable, Stable Funding*

Funding is provided either from multiple levels of government (federal, provincial) and industry (through a mandatory levy) or a combination of both. The sale of information products can augment revenues, but must not be relied upon for core funding and must not unduly restrict access to data by the public. The funding system will be transparent as to the source of the funds.

5.2.6 *Fully Integrated Across Media*

The World Class Information and Reporting System will include:

- gathering basic environmental information that is used in the assessment and interpretation of other monitoring data (e.g., climate, river flow, lake levels, etc.);
- gathering specific environmental information that is intended to determine potential effects of industrial development (e.g., air quality, surface water quality, groundwater quality, groundwater quantity, fish and wildlife, vegetation, soils, human health, etc.); and
- regional environmental monitoring programs undertaken by arms-length bodies and the site-specific monitoring required by government (AENV, ASRD, ERCB) that is carried out by individual companies.

5.2.7 *Ease of Access to and Clear Understanding of Data*

The World Class Information and Reporting System provides both ease of access to the data and clear understanding of implications arising from the data. This is done via a fully integrated *State of the Environment Report for the Oil Sands Region* synthesis document (see section 5.1.4 above for details). This report will discuss not only status and retrospective events, but will also forecast impacts and implications with possible mitigating strategies. This report will also compare predictions from environmental impact assessment reports and approval applications with actual impacts to allow improvement in the predictive tools.

5.2.8 *Reporting and Communication*

Excellent reporting and communication is a cornerstone of the World Class Information and Reporting System. Access is delivered through a single, integrated, web-based reporting system that provides both raw and analyzed data (elements of this approach are being developed by both Alberta Environment and the Oil Sands Secretariat). For example, this integrated portal could provide access to all oil sands environmental information by making all project documentation available on-line.

The reporting system will provide data, as close to real time as possible, in a variety of forms and formats that meet the needs of various stakeholders. The data will:

- be available on-line;
- have clearly articulated descriptions of how they were collected and what they mean and what should and should not be done with them; and
- will include all of the monitoring information collected in the region.

5.2.9 *Causal Relationships*

Causal relationship understanding is accomplished by establishing a significant independent scientific and investigative capacity that will examine both ecosystem effects and human health linkages. This capacity may be achieved by integrating various research activities across the province in addition to internal staff.

The data base will include historical data wherever possible and build on existing information rather than starting fresh.

5.2.10 *Understandable Information*

Information and data are provided in context so that both the public and decision-makers understand the implications without 'spin'. This requires:

- establishing capability to impartially interpret data;
- establishing benchmark indicators, thresholds and performance standards to measured against (including filling gaps as necessary);
- using a risk-based approach where the likelihood and consequences of adverse environmental impacts are considered; and
- making data available in multiple formats including raw data, science-based analyses and plain language analyses to serve the needs of a wide range of users.

5.2.11 *Operational Performance*

Operational performance of the World Class Information and Reporting System is of the highest standard. All processes and practices are reviewed and verified by independent review.

Information gathering, analysis and reporting will be standardized with consideration that a certified framework such as ISO or CSA be used or adapted where appropriate.

5.2.12 *Continuous Improvement*

The World Class Information and Reporting System employs the principles of continuous improvement to ensure that the World Class System remains relevant, credible and understandable. It is important that any improvements do not unduly compromise the ability to compare current data to baselines (or even year to year) as this would affect the ability to document change over time. The system itself must also be flexible to address the key objectives that can change over time. An appropriate training system is in place ensuring quality and continued upgrading of skills.

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7 GLOSSARY OF ACRONYMS IN THIS REPORT

ABMI	Alberta Biodiversity Monitoring Institute
AENV	Alberta Environment
ASRD	Alberta Sustainable Resource Development
CAPP	Canadian Association of Petroleum Producers
CEMA	Cumulative Environmental Management Association
CONRAD	Canadian Oilsands Network for Research and Development
CSA	Canadian Standards Association
EIA	Environmental Impact Assessment
ENGO	Environmental Non-Government Organizations
ERCB	Energy Resources Conservation Board

IFN	In-stream Flow Needs
IMERF	Integrated Monitoring, Evaluation and Reporting Framework
IRC	Industry Relations Corporation
ISO	International Standards Organization
NGO (see ENGO)	Non-Government Organizations
OSRIN	Oil Sands Research and Information Network
PADEMP	Peace Athabasca Delta Environmental Monitoring Program
RAMP	Regional Aquatic Monitoring Program
SRD (see ASRD)	Sustainable Resource Development
TEEM	Terrestrial Environmental Effects Monitoring
TEK	Traditional Ecological Knowledge
TMJWG	Terrestrial Monitoring Joint Working Group
WBEA	Wood Buffalo Environmental Association

APPENDIX 1: Guiding Assumptions for Developing an Effective Public Information and Reporting System for Ecosystems in the Oil Sands Region

The following list of guiding assumptions is intended to more accurately describe the thinking leading up to this report.

1. The federal government also has an important role and obligation with respect to monitoring and reporting (for example, to address trans-boundary impacts, fish habitat, species at risk, migratory birds, Aboriginal health, etc.). It is important that the federal government and government of Alberta work together to compliment each other's roles and avoid duplication.
2. Public confidence that an adequate and effective system of information and reporting is in place to detect and report on ecosystem effects is a critical element of ensuring the social license to develop the oil sands and to inform responsible decision-making. Public confidence will be gained if the information and reporting system is based on sound science and is used to support decisions regarding oil sands development.
3. Various monitoring programs exist (see Appendix 2) but the programs do not appear to be coordinated, and their results are not always easily accessible to the public and/or are considered proprietary. Historic monitoring data were collected for different purposes and it may not be possible to simply bring this together to evaluate ecosystem health in a science-based manner.
4. The variety of ecosystem effects are not known or are poorly known in the region subject to oil sands development.
5. Although monitoring is occurring, it is not generally known what the current information and reporting 'system' is, and whether it is effective. At a minimum, the current system needs to be better communicated with improved access to data and information. Ideally, there should be a single point of contact where the public can easily obtain information.
6. The current monitoring and reporting of cumulative ecosystem effects is regarded with skepticism by some stakeholders. This may be because they:
   - regard both government and industry as lacking credibility; and/or
   - feel the information and reporting is not open and transparent; and/or
   - feel the current system is not tailored to measuring ecosystem effects in a credible manner.
7. Credibility would be enhanced if stakeholders felt that an adaptive management framework is in place to evaluate measured impacts relative to the predicted impacts to confirm that they are accurately measured and reported, and then where necessary adjust the predictive models and implement remedial actions.
8. There is a view that industry should bear the costs of monitoring (either directly or indirectly via revenues paid to government), but that the goals and methods need to

be set by government in consultation with others (industry, stakeholders, First Nations, academia, etc.) so that quality data are produced. Another perspective is that government should play a more active role in broad regional monitoring and to ensure an effective overall monitoring system is in place.

9. The cost of an adequate and effective public information and reporting system needs to be established in the context of what is appropriate given the scale of oil sands development and associated ecosystem effects, providing that an acceptable base level is achieved and maintained.

10. Integration of various monitoring programs into a coherent and streamlined information and reporting system that is regularly and openly validated by peer review would substantially increase public confidence in environmental performance and reports of cumulative impacts. The reporting needs to be simple but underpinned with sound science. In some cases, existing monitoring programs will need to be augmented.

11. Raw scientific and operational data alone are often not useful to the public and decision-makers due to a variety of issues:
    - Inadequate context (how does this piece of information fit into the picture?),
    - Communication difficulties (use of scientific jargon, interpretation of statistical data, etc.)
    - Lack of ease of access (where only reported to government and not readily available to the public, in conference proceedings, etc.).

    These issues need to be addressed for scientific data to become a useful information source to the public and decision-makers.

12. Transparency will be critical to a successful public information portal: both the data and the interpreted results should be made more readily available. This should also be supported by communication to enhance public awareness regarding key findings.

13. Thresholds, goals and objectives are needed to inform the information and reporting system and these would stem from the documents such as the Oil Sands Strategic Plan and the Lower Athabasca Regional Plan.

14. Information and reporting needs to be provided in the context of risk management. The reporting should be in context of the risk of the contaminants to ecosystem and human health.

15. It is possible to develop a solution, a set of solutions or a set of scenarios regarding an adequate and effective public information and reporting system that will satisfy the vast majority of stakeholders.

16. The information and reporting system will be based on sound science as a core principle. Community-based and traditional knowledge should constitute part of a

comprehensive information and reporting system: this would enhance confidence within aboriginal communities that the system addresses their interests.

APPENDIX 2: Partial List of Ecosystems Effects Monitoring Programs Active in the Oil Sands Region

Currently a series of independent monitoring programs are in place in the oil sands region (see Lott and Jones 2010 for more details on many of these programs). These programs are operated by different organizations and funded by a variety of sources in industry and government.

- Water quantity and quality are monitored regionally by the Regional Aquatic Monitoring Program (RAMP), which is funded largely by the oil sands industry. www.ramp-alberta.org/RAMP.aspx
- Air quality and pollutant deposition is monitored by a series of stations operated by the Wood Buffalo Environmental Association (WBEA). WBEA also monitors acid deposition. WBEA's largest program is in Terrestrial Environmental Effects Monitoring (TEEM). www.wbea.org
- Impacts of development on plants and animals are tracked by the government and industry funded Alberta Biodiversity Monitoring Institute (ABMI). This program is currently of limited scope. www.abmi.ca/abmi/home/home.jsp
- Alberta Environment maintains its own aquatic monitoring system which encompasses part of the oil sands region, and through its Integrated Monitoring, Evaluation, and Reporting Framework (IMERF) intends to facilitate better integration. Work underway with IMERF and the development of an Oil Sands Information Portal are intended to improve access to information.
- Other potential monitoring information sources include the federal government (e.g., National Pollutant Release Inventory, National Forest Inventory, State of Environment reporting, and State of Forests reporting), Alberta State of Environment reporting and its approach to Regional Strategic Environmental Assessment. The extent of these programs needs to be determined.
- CONRAD through the Wildlife Habitat Effectiveness and Connectivity Program. www.conrad.ab
- PADEMP – Peace Athabasca Delta Environmental Monitoring Program (considering regional impacts in the Delta).
- AENV Oil Sands branch monitoring initiatives that fall under various management frameworks. These are related to IMERF but are being developed independently: groundwater, surface water, air, reclamation and disturbance.
- Sustainable Resource Development in partnership with several oil sands developers have initiated a Terrestrial Monitoring Joint Working Group (TMJWG). The purpose of the group is to design a regional monitoring system that will contribute to standardized and systematic approach with ABMI as the foundation for the integrated monitoring program.

- Considerable monitoring is undertaken by oil sands companies that are reported to government.
- The Cumulative Environmental Management Association (CEMA) has mandate to study the cumulative effects of industrial development in the Wood Buffalo region, and currently is being expanded to review impacts of the IFN Phase 2 Framework. www.cemaonline.ca/
- The Fort McKay Industry Relations Corporation (IRC) is very interested in monitoring and taking a collaborative approach and is undertaking activities aimed to be credible locally and to a broader audience.

APPENDIX 3: Current Status of Some Existing Environmental Effects Monitoring Programs (as of June 2010)

The following updates were provided at the June 2010 Integrated Monitoring and Reporting Workshop.

Integrated Monitoring, Evaluation and Reporting Framework (IMERF)

Susan Johnstone with Alberta Environment provided a brief update on the IMERF project. The project started about a year ago in response to issues similar to those that prompted this Dialogue. IMERF is intended to be a principle-based framework where both spatial and temporal integration is envisioned. A key driver is to help ensure key information is available to support decisions made by Alberta Environment. Part of the data management will be a quality classification. Alberta Environment prepared a draft Framework in October 2009. The intent is that in general the data would be publicly available although some information may be withheld should it be necessary to address the protection of privacy. Overall, IMERF's goals and background are very similar to those noted by OSRIN in support of this Dialogue.

Regional Aquatics Monitoring Program (RAMP)

Fred Kuzmic provided an update on RAMP. RAMP was initiated in 1997 with a multi-stakeholder oversight including industry and government, and initially also First Nations. RAMP is primarily funded by industry with focus on lakes and rivers. Baseline conditions are monitored to ascertain the natural range of variability. Baseline conditions are monitored to ascertain the natural range of variability, and then monitored during the subsequent development to ascertain trends and to compare them with EIA predictions. A community component of RAMP assesses fish. Consultants are hired to run RAMP and technical committees are formed to help ensure proper scientific design. In 2004, a peer review was completed and RAMP is addressing issues raised. The design and rationale for the program is provided in a comprehensive 600 page document. Another peer review is currently underway.

One of the recommendations from the current review might be that RAMP data be made more publicly available (the concern in the past was that companies who are not contributing financially to RAMP would get free access to use the data which could undermine the financial support needed for the program).

About $4 million is spent each year on fish, benthic/invertebrate, sediment, water quantity and quality, and acid-sensitive lake work. Companies can choose to be a part of RAMP, and pay for the data collected to support their operations, or can opt to do their own data collection. RAMP is currently not a legal entity but going that route is under consideration.

Responsible Actions: A Plan for Alberta's Oil Sands

Jennifer McGill, Oil Sands Secretariat, summarized some of the follow-up activities stemming from the 2009 report *Responsible Actions: A Plan for Alberta's Oil Sands* (Government of Alberta 2009). One of the challenges was how to measure 'being responsible': what data should be collected and how should stakeholders be involved? Twenty-two national and international programs were reviewed that addressed social, economic and environmental indicators. Via

review with stakeholders, 31 indicators were initially identified. About 80% of the indicators have existing data. The Secretariat is currently in the process of validating the indicators and gathering information regarding them. In Fall 2010 they expect to have baseline data collected publicly available. A challenge being addressed is how "to connect the dots regarding the indictors and supporting data in order to tell a story". The intent is to provide a regional perspective and to have access to the information via GeoDiscover Alberta.

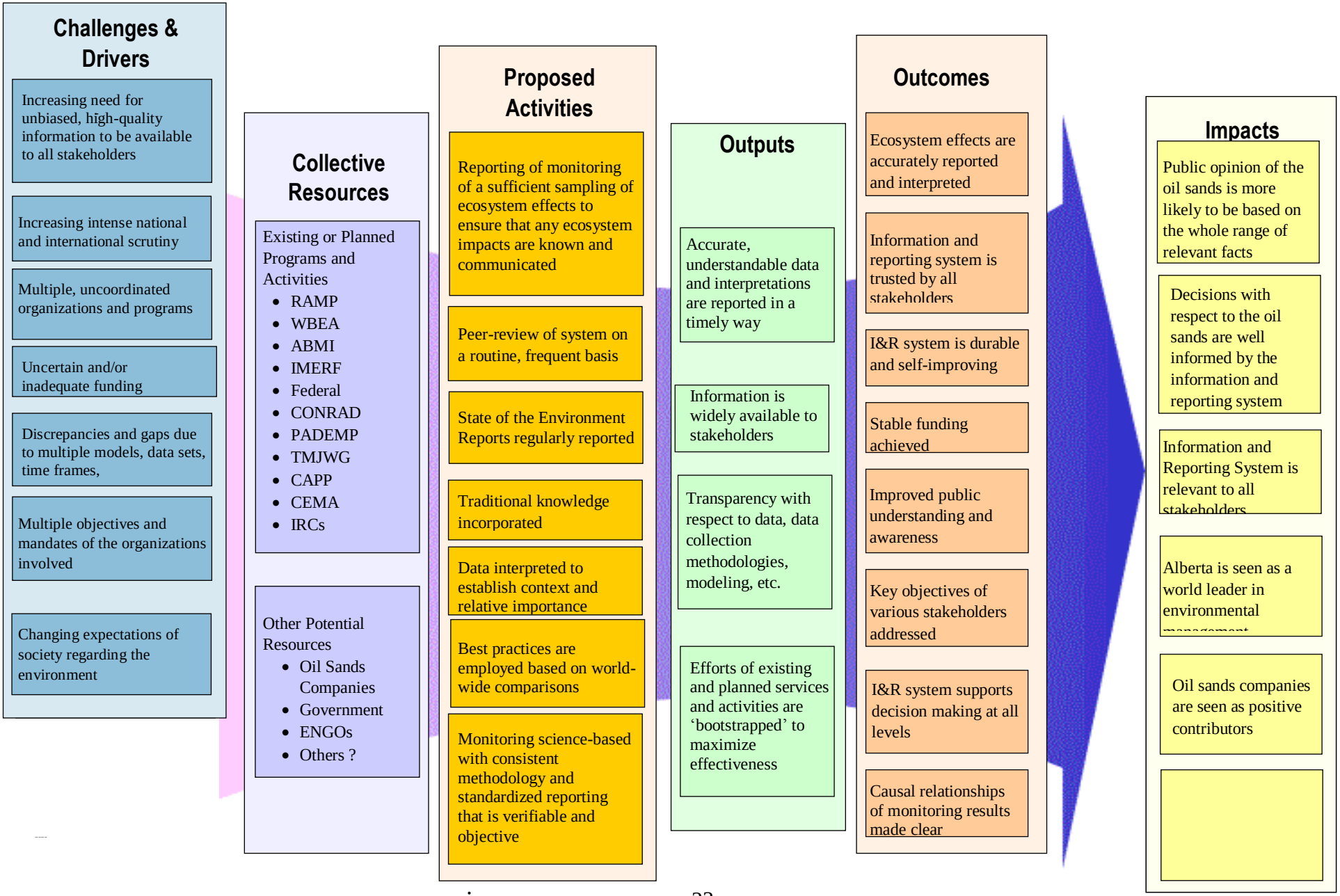
Alberta Biodiversity Monitoring Institute (ABMI)

Jim Herbers, ABMI, provided a brief update on ABMI as it relates to the oil sands area. Monitoring efforts in northeast Alberta have been undertaken to support approvals under the Environmental Protection and Enhancement Act (EPEA). The information collected helps support a company's environmental impact assessments (EIAs). Regarding this effort, developing a vision on how the data could be more broadly used might improve the transparency considerations with approvals.

Cumulative Environmental Management Association (CEMA)

Fred Kuzmic provided an update on CEMA. CEMA is involved in data collection but not monitoring. CEMA includes a Traditional Environmental Knowledge (TEK) component, and a strong communications aspect. The Board overseeing CEMA is representational with four from industry, four from government, four from First Nations and four from NGOs. Currently, there is not really a cumulative impact program in place. Industry invests about $19 million per year collectively to CEMA, RAMP, WBEA and related programs. It was noted that it is hard to get data from CEMA but that CEMA recognizes this and is trying to deal with it.

APPENDIX 4: Draft Logic Model for the Information and Reporting System



APPENDIX 5: Mapping of Key Findings to Principles and Elements

This table maps the recommendations collected from Workshop participants to the relevant Key Principles required to build an effective Information and Reporting System. The recommendations are grouped into two categories: the upper (white) group is for the Enhanced System and the lower (blue) group is for the World Class System.

Principles	Key Elements	Suggestions to Achieve an Effective Information and Reporting System
Principle #1: Relevant	1. The information and reporting system needs to address key objectives (e.g., as expressed from a variety of sources including provincial strategies, regulations and reporting requirements for industry; regional land use plans; local communities and First Nations).	• Monitoring programs can support both regulatory requirements and non-regulatory best practices • Issue: Important to document why the program is designed the way it is (and why modified over time) for corporate memory and public confidence
		• Need assessment and gap analysis beyond province to address questions being raised by people outside of province • The entity can set monitoring standards for other activities such as environmental impact assessments (potentially including assessment of GHGs) • System needs to be designed to address different 'scales' of question: at provincial and national level, and a regional level
	2. The information and reporting system must support a business management decision process and be responsive to the needs of decision-makers so that the information and reporting is used to make timely and well informed decisions.	• Need to be responsive to who needs information and when it is needed • The program should be substantiated (defended) from two perspectives: national/global and regional/site scales • System is only as strong as its weakest link with respect to credibility
		• The entity should be responsible for all kinds of monitoring except the regulatory monitoring that industry does • Differentiate between monitoring and decision-making – keep them separate • The entity would inform regulatory agencies, companies and public when issues arise (e.g., raise 'red flags' where agreed to thresholds have been breached), and report on actions • The entity should in fact be 'all things to everyone' in that it can respond to various questions raised at different scales of interest/concern • Delegated authority for monitoring under legislation/regulation is a potential vehicle to make this happen

Principles	Key Elements	Suggestions to Achieve an Effective Information and Reporting System
		• Need to carefully design a world class system; getting it right will likely take more than a year • The benefits of providing proactive information need to be made clear (e.g., the value with improved science-based knowledge)
	3. Reporting should capture both transient events and trends to address both the long and short term needs of the various stakeholders.	• There are probably more gaps in information than inefficiencies with current system • Legacy programs – need for continuity and public confidence which suggests program should carry on; only stop if confident the information will not be needed • System needs to be flexible with acknowledgment that requirements may change to address use of data in the future
	4. The information and reporting system needs to support local, regional and national assessment and reporting of ecosystem effects.	• Need an extension arm as exists for Agriculture • Monitoring design should be with the province in mind that can be more detailed to fit the operational needs of northeast Alberta where oil sands development is occurring
Principle #2: Credible	5. Information and reporting about ecosystem effects in the oil sands region needs to be science-based and employ recognized best practices with appropriate quality assurance measures applied and subject to periodic peer review.	• The claims of government and industry regarding environmental performance need to be backed up with data • To address public perceptions, it is important that data providers are at arm's length, that the client (data user) does not affect the kind of information being collected and reported, and that monitoring that is separate from government regulatory bodies
	6. Information, including monitoring, needs to be reviewed and verified. Information gathering, analysis and reporting should be standardized with consideration that a certified framework such as ISO or CSA be used or adapted where appropriate.	• Need to invest time in design up front to address statistical validity, scale, etc. • Monitoring and reporting should be at media level including assembly of information and communication • May be an external integrator might see things in the weeds that information providers don't see • Potential problems with misuse of metadata underscores need for quality control so that data are not taken or used out of context • Also issue with proprietary data and ability to use and access this information • Current quality of information is variable
		• Does ISO world class monitoring structure exists that we can consider or use? • A technical (peer review) committed can assist

Principles	Key Elements	Suggestions to Achieve an Effective Information and Reporting System
	7. A collaborative structure providing oversight involving government, industry, First Nations, academia and non-government organizations will enhance credibility of an information and reporting system	• Potential to integrate monitoring program operations • Administrative integration of monitoring programs another consideration • Integration considerations include reporting, funding, continuous improvement, and governance (e.g., a corporation involved in information and reporting) • Oversight is needed to integrate and amalgamate when it makes sense but don't unnecessarily integrate where it does not make sense • Regarding organization and governance, do you combine information and reporting programs or do you preserve the existing entities; what would be role and mandate of an overarching body; separate by media (air, land, water, biodiversity). • The functions of data collection, evaluation, synthesis, communication and application need to be made clear with critical separations made between data providers and use of data to support decision making • Integration of monitoring and reporting should involve communities • External integration at high level with First Nations/stakeholder involvement providing oversight but not involved in detail or design; science by committee is bad
		World Class Integration necessary • Provides logistical and operational efficiency • Allows reporting of media interactions (correlative aspect) • Media not independent – need to be looking for holistic relationships Options To Consider: *Model 1*: An integrating body reports on information collected by existing monitoring programs (e.g., ABMI, WBEA, RAMP) *Model 2*: One single organization runs entire information and reporting system for all media • An independent entity is needed to deliver a world class system • Strategic partnerships with existing monitoring programs (such as ABMI), industry (such as via CAPP), and NGOs (e.g., Alberta Conservation Association, Pembina Institute) are needed

Principles	Key Elements	Suggestions to Achieve an Effective Information and Reporting System
		• Although independent from decision-makers, the monitoring program needs to respond to client needs such as decision-makers regarding the types of information needed (arms-length data providers with clear linkages to decision-making so that the interface between information and decision-making is actively managed; similar to researchers who need to be responsive to their customers/clients) • Multi-stakeholder oversight should be provided (with board structure) • Oversight review committee (e.g., industry/government) needed to help steer system Entity needs to be arm's length and provide credible data; be independent with external recognition or certification • An institute could be formed that provides oversight, research capability, and that does the monitoring; test monitoring techniques (research arm) before making operational • The institute or university should be self-contained where system design, synthesis, quality assurance/quality control, interpretation, evaluation and release of information using newest technology available can be effectively delivered • Concern will be fear of losing current programs • Need significant political leadership to make this happen • A commitment and structure is needed at a high level to make this happen (e.g., federal and provincial government buy-in at the deputy minister level)
Principle #3: Understandable	8. Complex science-based information needs to be interpretable, and interpreted, so that the public and decision-makers understand its meaning (e.g., using "plain language" rather than scientific terms; using a risk-based approach where the likelihood and consequences of adverse environmental impacts are considered). This results in the need for multiple information formats including raw data, science-based analyses and plain language analyses.	• Important to separate benchmark indicators and thresholds ▪ There is issue of integration across various users of information as well as integration across various media (land, water, air) ▪ Monitoring design may be different for valid reasons ▪ Purpose/objectives of monitoring are different which can be barrier to integration • Need to be careful regarding how data are packaged without 'spin' • Performance standards and indicators needed to report against • Need for data standards to encourage appropriate use • Do some core (basic) interpretations but allow others to interpret based on availability of raw data • Need in-house capability to do interpreting • Need mechanism to ensure impartial interpretation e.g., give an impartial third party group the funding to interpret who do not have a conflict of interest

Principles	Key Elements	Suggestions to Achieve an Effective Information and Reporting System
		• A potential barrier is developing a comprehensive system that can deal with the complexity of ecosystems • *Issues* ▪ We are not using the data we are currently capturing ▪ Lack of benchmarks ▪ Collection of key indicators
		• Active interpretation of data needed • Ability to answer questions proactively (earlier) rather than reactively (after it is raised) is clear benefit • There needs to be appropriate training system in place • If we collect more or different data, we need to know why (rationale)
	9. The causal relationships of ecosystem effects need to be understood so that information and reporting is directed to appropriate decision-makers and to avoid misinforming the public (e.g. not all impacts in the oil sands region are due to oil sands development, rather other sources of effects may be causing the impacts). This will involve developing linkages between the information and reporting system and existing and ongoing research into causal relationships.	• The investigative science part that leads to cause-effect evaluations should be a separate arm (of government) from those undertaking core and customized monitoring • Providing context is more important than enhanced interpretation • There is benefit in cumulative effects monitoring as you learn things not expected
		• Causal relationships needed to be evaluated (identify, confirm) • A problem solving investigative branch of the entity is needed • There should be a research arm • Health linkages should be part of system
Principle #4: Transparent	10. The public information and reporting system must be transparent with respect to data collection methods, data collected, and models used for evaluation. Data should be	• Who is going to do this? (government, industry, third party?) • Who is it for? What questions need answering? • There tends to be a bias against reporting with data collection specialist • More data likely being collected than being used (are data sometimes collected for the sake of data collection? Are significant amounts of data unused?)

Principles	Key Elements	Suggestions to Achieve an Effective Information and Reporting System
	released early as "best available" information with provisos in context with its intended application, and as "final" when appropriate.	• Information technology infrastructure has not kept pace with the amounts of data being collected • There is sometimes a 'run around' with respect to getting information from companies and government which makes it difficult for the public to access data • Ombudsman for data requests should be considered • Self-service access to data should be goal so current concerns from government about costs of meeting data requests are addressed (e.g., a common portal to all oil sands environmental information where all project documentation is available on-line). This requires changing expectations of public access to data • CEMA dataset library should be considered
		• Real time automated data should be provided with less people involved in data handling • There should be a university affiliation and extensive network built so that best global practices are applied in a world-class information and reporting system • A '24 hour a day/7 days' a week approach to responding to emerging issues • The entity should provide 'one-stop shopping' with respect to information and reporting for ecosystems for entire province (not just area subject to oil sands development) – with initial focus on the 'oil sands area' • The raw data should be available on-line • The entity should be considered a 'centre of excellence'
	11. A fully integrated *State of the Environment Report for the Oil Sands Region* synthesis report should be published periodically (e.g., complete cycle for all sectors every 3 to 5 years, with specific sectors reporting each year on a rotation). A collaborative structure led by the Government of Alberta (such as described in element #7 above) that oversees the development of the report as well as peer review to ensure	• High priority should be given to an Alberta State of the Environment report that includes areas covered by oil sands operations with annual reporting • One report such as this can help coordinate reporting on results of various monitoring programs • Questions cross environmental media • There is need to monitor groundwater • An index of environmental integrity should be considered where its state can be assessed (e.g., good, fair and poor) • There should be ability to undertake environmental forecasting where trends show some indicators are improving, some with no significant change, and some deteriorating • Should those providing information do the forecasting or should the data be made available to enable stakeholders to do it? • Are there gaps? Assessment of regulation reports? Right information being provided?

Principles	Key Elements	Suggestions to Achieve an Effective Information and Reporting System

	the report is based on sound science will enhance its credibility. The report should document ecosystem changes and management efforts to avoid, mitigate or lessen impacts. It will be necessary to establish the region boundary, or otherwise make it clear the intended scope of the report.	Further work required to evaluate this
		• Barriers:
		  o Complexity of ecosystems
		  o Funding/resources/capability issues
		• Issue: How do we integrate data from different sources?

		• Gap is lack of historic benchmarks; need to find proxies • Reporting frequency should be current for some components such as air quality and water flow, but less important for other components such as soil and vegetation • Access experts outside but transfer knowledge to Alberta

Principle #5: Robust	12. The information and reporting system should be independent with stable, long-term funding.	• Adequate funding needed for existing monitoring programs
		• Consider a mandatory levy to provide a fair funding system as 'price of doing business'
		• Need stable funding – either guaranteed funds to invest in information and reporting (e.g., legislatively requires this), or assured product to sell that produces stable income
		• Funding source is critical and must be available in a timely manner; stable funding raises credibility; stability also allows forward planning and better supports effective decision-making
		• Industry pays for monitoring which currently is applied as a royalty offset so in effect the public does pay
		• Concern about long-term funding; need value review to ensure good value for investment
		• Should be core monitoring where everyone pays, and additional monitoring that individuals fund
		• Barriers to stable funding include:
		  ▪ Fear that dollars spent not efficient or effective
		  ▪ Concern that may not encourage program review of merit/use/value of information collected
		  ▪ May be different monitoring needs. Needs for different purposes; should pay for universal regulations but not specialized (operator or site) requirements
		  ▪ Funding/resources/capability issues

		• Agree to business (scope of) funding • Endowment based funding can finance system • To help offset costs, a fee for service work can be charged • Challenge will be securing needed dollars to deliver a world-class system

Principles	Key Elements	Suggestions to Achieve an Effective Information and Reporting System
	13. A high quality information and reporting system will employ the principles of continuous improvement to ensure that it remains relevant, credible, understandable and transparent. It is important that any improvements made do not unduly compromise the ability to compare current data to baselines (or even year to year) as this would affect the ability to document change over time. The system itself must also be flexible to be able to address the key objectives that can change over time	• System needs to be flexible with acknowledgment that requirements may change to address use of data in the future