OSRIN Annual Report: 2010/11

Oil Sands Research and Information Network

University of Alberta

School of Energy and the Environment

April 2011

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.

Citation

This report may be cited as:

OSRIN, 2011. *OSRIN Annual Report: 2010/11*. Oil Sands Research and Information Network, School of Energy and the Environment, University of Alberta, Edmonton, Alberta. OSRIN Report No. SR-6. 34 pp.

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.

Table of Contents

ACKNOWLEDGEMENTS

The Oil Sands Research and Information Network (OSRIN) acknowledges the continuing and valued support of the Board of Directors in helping us get the program up and running.

OSRIN is also very grateful for the advice and guidance provided by Joseph Doucet, past Director of the School of Energy and the Environment and Chair of the OSRIN Board of Directors, and the leadership provided by Dr. Steven Moran during his tenure as Executive Director of OSRIN.

OSRIN greatly appreciated the support of Lorraine Nichols, University of Alberta School of Business and her web team in getting the website design completed and their ongoing support for content management. OSRIN is also grateful to Leah Vanderjagt and Carrie Jackson of the University of Alberta Libraries for their support of the Education & Research Archive storage facility for OSRIN's reports.

Finally, OSRIN thanks the core funding agencies – Alberta Environment and the Canada School of Energy and Environment Ltd. – for their commitment to the program.

1 INTRODUCTION

This report describes Oil Sands Research and Information Network (OSRIN) activities and accomplishments for the fiscal year April 1, 2010 – March 31, 2011.

Key accomplishments for OSRIN this past year include:

- Development and deployment of the website;
- Publication of 12 technical reports arising from contracted research;
- Publication of five staff reports, including the *Glossary of Terms and Acronyms used in Oil Sands Mining, Processing and Environmental Management*. OSRIN Report No. SR-1. 102 pp.
- Digitizing and making publically available as pdf documents 39 research reports from the Reclamation Research Technical Advisory Committee program; and
- Digitizing and making publically available as pdf documents 57 research reports from the Alberta Oil Sands Environmental Research Program.

Publication of these reports provides the public and researchers with additional information on environmental management of oil sands impacts. They are available from the University's Education & Research Archive (http://hdl.handle.net/10402/era.17209).

OSRIN is particularly proud of the positive feedback received from various stakeholders, including the provincial and federal panels established to review oil sands monitoring programs, regarding the monitoring reports we produced:

> James, D.R. and T. Vold, 2010. *Establishing a World Class Public Information and Reporting System for Ecosystems in the Oil Sands Region – Report and Appendices*. OSRIN Report No. TR-5. 189 pp.
>
> Lott, E.O. and R.K. Jones, 2010. *Review of Four Major Environmental Effects Monitoring Programs in the Oil Sands Region*. OSRIN Report No. TR-6. 114 pp.

1.1 Board of Directors

The Board of Directors met in July, 2010. The Board was chaired by Dr. Joseph Doucet, Director, School of Energy and the Environment, University of Alberta. Chris Powter, Executive Director of OSRIN participated as a resource to the Board and Doug Leong provided secretariat functions.

The Board was expanded (new), and members changed during the course of the year (change). Board members included:

Roger Ramcharita	Alberta Environment (change)
Terry Abel	Energy Resources Conservation Board (change)
Neil Barker	Alberta Sustainable Resource Development (new)
Ted Cyr	Alberta Energy

Jennifer McGill	Alberta Finance and Enterprise, Oil Sands Secretariat (new)
Robert Fernandez	Alberta Finance and Enterprise, Oil Sands Secretariat (change – replaced Jennifer McGill in the fall)
John Zhou	Alberta Innovates – Energy and Environment Solutions (change)
Bruce Carson	Canada School of Energy and Environment (CSEE)
David Layzell	Institute for Sustainable Energy Environment and Economy (ISEEE)
Julia Foght	University of Alberta – representing the Office of the Vice-President of Research (change)

Joseph Doucet, Director of the School of Energy and the Environment, was Chair of the Board of Directors in 2010. Stefan Scherer took over the position of Director of the School of Energy and the Environment, and also the Chair of the OSRIN Board of Directors, in March 2011.

1.2 Staff

Chris Powter was hired as Executive Director in April 2010. Dr. Stephen Moran, the previous Executive Director, remained on a part-time basis as Senior Research Program Advisor until March 2011. Doug Leong was hired as program administrator in April 2011 and remained in the position until the end of November 2010; Caroline Simpson continued to provide support for specific projects in April and May 2010, and then returned for the period December 2010 to March 2011. Barbara LeFort was hired as Administrative Assistant in March 2011.

Two MBA students worked on a variety of projects, with the primary emphasis on developing the structure and content of the Innovation Asset Database, until the end of August 2010.

1.3 Report Organization

Section 2 provides an overview of projects funded by OSRIN during 2010/11.

Section 3 outlines OSRIN's revenue, expenditures and remaining funds. OSRIN received $20,217.50 and spent $853,717.93 during 2010/11, leaving $2,631,634.19 available for future OSRIN work. Appendix 4 provides a detailed breakdown of project-related expenditures.

Section 4 provides an outlook for 2011/12.

Appendices 1 to 3 provide background information on OSRIN's strategic approach.

2 2010/11 PROGRAM

OSRIN has identified six program areas in which we are funding work. Within each program area we have launched projects to scope out the state of knowledge, identify knowledge gaps, and provide insights regarding research priorities.

- Tailings Reclamation
- Regional Landscape Reclamation
- Monitoring Ecosystem Impacts
- Increasing Awareness

- Social, Economic and Regulatory
- Strategic Design

Projects are listed in alphabetical order in each program area. All expenditures noted in the summaries below are funds spent in the fiscal year (April 1, 2010 to March 31, 2011) and include direct projects costs expended under grants, purchase orders and invoices (details are provided in Appendix 4). Some projects had expenditures in fiscal year 2009/10 – these are noted in Appendix 4. Additional costs associated with projects are included in the total costs shown section 3.2. Some project costs will extend into the 2011/12 fiscal year. Grants show as fully spent since the funding was transferred to the grantee even if the grantee had not yet used all of the funds by March 31, 2011.

OSRIN Publications, arising from the work described below, and from previous work, are found on the website at http://www.osrin.ualberta.ca/en/OSRINPublications.aspx.

2.1 Tailings Reclamation

2.1.1 *Objective*

This program seeks to identify challenges that must be addressed in accelerating the reclamation of tailings ponds and disposal areas and to catalyze necessary research efforts to resolve them.

Challenges for tailings reclamation include:

- Accelerating the dewatering of fine tailings
- Treatment of process affected water for environmental release or for recycling or reuse
- Reclamation of dewatered fine tailings
- Quantifying and managing release of gases, such as hydrogen sulphide or methane, during tailings pond reclamation

2.1.2 *2010/11 Projects*

Engineered Biological Processes to Accelerate Oil Sands Tailings Consolidation and Improve Reuse Water Quality

Performer: Dr. Tong Yu, Department of Civil and Environmental Engineering, University of Alberta

Status: Completion August 31, 2012

Expenditure: $0 (grant funds allocated in 2009/10)

Next Steps: Depend on results

Methanogenesis has been demonstrated to occur in oil sands mature fine tailings with improved fine tailings densification. While research is on-going as to the microbial processes occurring, there is no open public research to adapt engineered wastewater treatment technologies that exploit the microbially-mediated processes. This study will explore engineered microbially-activated water treatment to significantly accelerate oil sands tailings consolidation and improve

quality of water produced from the treatment processes for reuse. The project will study a number of biological processes and engineering reactor types to find the effective combination for achieving outcomes listed in greater detail below. The engineered biological processes will employ both suspended and attached microbial growth and both anaerobic and aerobic processes. In addition to determination of the parameters for the design and operation of these engineered reactors, additional measures for enhancement of the reactor performances will also be investigated. If successful, the proactive engineering approach could significantly shorten the time for water-solids separation, reduce the volume of tailings produced, and improve water quality for reuse. The long-term goal is to avoid production of mature fine tailings as we now know it. The knowledge and experience obtained from this study can also be used to better treat existing mature fine tailings.

Mining Clean Bitumen Technology Action Plan (CBTAB)

Performer: Petroleum Technology Alliance Canada (PTAC)

Status: Completed

Expenditure: $400.00

Next Steps: None

OSRIN supported this multi-player project to identify technology opportunities for breakthrough improvement in environmental and economic performance in oil sands development. OSRIN's primary interest is in technologies related to minimizing and managing tailings ponds. OSRIN is one of 23 investors that participated on the Mining Steering Committee.

Quantitative Characterization of Air Pollutant Emissions from Oil Sands Tailings Ponds: Phase 1 Review and Assessment of Air Pollutant Measurement Technologies

Performer: Dr. Zaher Hashisho, Department of Civil Environmental Engineering, University of Alberta

Status: Work ongoing

Expenditure: $0 (grant funds allocated in 2009/10)

Next Steps: Depend on results

Because of the differences among the fundamental principles and operations of air pollutants measurement techniques, the performance of these techniques in the measurement of fugitive emissions of air pollutants from oil sand tailing ponds and other area sources can vary. Such variability adds another layer of complexity to the temporal and spatial variability inherent in fugitive emissions from tailing ponds. The choice of a technique for characterizing air pollutants emissions from tailing ponds needs to consider, in addition to accuracy, other factors such as the practicality, cost, and reliability of the technique. Hence there is a need to understand the

advantages and limitations of these techniques in order to select the technique that is most suitable for measuring air pollutants emissions from tailing ponds. This project will (1) review characterization technologies for Volatile Organic Carbon (VOCs), methane (CH_4), and hydrogen sulphide (H_2S); (2) review technologies used in characterizing air pollutants emissions from oil sand tailing ponds; and (3) assess the performance of a photo-ionization detector (PID) for measuring VOCs under a range of environmental conditions.

Reclamation of Dewatered Fine Tailings

Performer: BGC Engineering (Silva, Biggar, McKenna, Scordo)

Status: Completed; report released

Expenditure: $30,334.30

Next Steps: None

BGC Engineering Inc. (BGC) conducted a scoping study of the state of knowledge related to technologies for reclaiming oil sands tailings substrates to upland boreal forests and wetlands for the Oil Sands Research and Information Network (OSRIN). The objective of the scoping study is to help establish an understanding of the status of fine tailings reclamation technology in the Athabasca Oil Sands Region (AOSR). Relevant research was compiled from peer reviewed and non-peer reviewed sources including journals, conference proceedings, magazine articles, and internal and consultant reports. Industry researchers and academics were contacted for their information.

Until recently, a wet landscape scenario, in which mature fine tailings (MFT) would be stored in pits and capped with a layer of freshwater to form an artificial lake, was the most likely reclamation option for MFT. In this scenario, pit lakes (PL), or end-pit lakes (EPL) are designed to remediate process-affected waters from tailings landforms through bioremediation and dilution. As an alternative to water-capping, much of the current research has focused on reclamation technologies that would result in a dry landscape.

Reclamation of fine tailings using a dry landscape scenario first requires stabilization of the deposit to allow access for heavy machinery (trafficability). Soil cover designs and revegetation prescriptions are used to reclaim the tailings substrate to an equivalent land capability or ecosystem function. Wetland design and upland forest reclamation are active areas of research in fine tailings reclamation, including the potential impacts of increased salinity on plant species selection, germination and growth.

Tailings Dewatering Technology Review

Performer: BGC Engineering (Silva, Biggar, McKenna, Scordo)

Status: Completed; report released. Chris Powter presented the results at the Tailings and Mine Waste '10 conference in October.

Expenditure: $39,998.64

Next Steps: Update the report in 2012/13 with new information or new technologies

The search for a viable tailings dewatering technology will intensify as the already large quantities of liquid waste products generated by the oil sands industry grows and tailings storage facilities fill nearer to capacity. BGC Engineering Inc. (BGC) conducted a review of existing tailings technologies for the Oil Sands Research and Information Network (OSRIN).

Over the years, many technologies have been proposed and field tested but they have been rejected for lack of technical or economic feasibility. With no unique and acceptable solution yet in sight, research is now focusing on schemes which utilize more than one technology and combine them into a disposal package.

This report presents an in-depth review of the state-of-knowledge related to oil sands fine tailings treatment technologies. All information is from publicly available sources at the time of writing. The aim of this report is to serve as a fundamental planning document for future research initiatives by OSRIN and other research agencies to support, promote, and improve the oil sands industry's capability to deal with the challenges of fine tailings management.

BGC and OSRIN compiled these references by contacting industry, government, and university researchers, as well as from searches of electronic databases and our own files. We identified 34 oil sands tailings treatment technologies that are discussed and analyzed from a fundamental and practical point of view. The technologies were divided into five groups:
(i) Physical/Mechanical Processes, (ii) Natural Processes, (iii) Chemical/Biological Amendments, (iv) Mixtures/Co-disposal, and (v) Permanent Storage.

Considerable research has been conducted to date to develop improved understanding of tailings behaviour, as well as the performance of various treatment technologies so the body of literature in this area is very large. We have collated a large number of references from which this synthesis was developed, and provided these references in a pdf format for more in-depth review by researchers. Researchers are encouraged to undertake their own detailed review of available references to better understand what has been done and learned to date.

Tailings Water Management Project

Performer: Alberta WaterSMART (Godwalt, Sturgess)

Status: Completed; report released

Expenditure: $0 (grant funds allocated in 2009/10)

Next Steps: None planned at this time; OSLI is pursuing subsequent phases of the project.

The study evaluates treatment requirements and technologies for three alternative uses of process affected water from tailings ponds: (1) recycling for other uses within the mines, (2) release to the Athabasca River, and (3) make-up water for in situ oil sands projects. The project also examines the economic and environmental costs on a whole system, life cycle basis for utilizing saline groundwater and tailings pond water for in situ projects.

2.2 Regional Landscape Reclamation

2.2.1 *Objective*

This program focuses on providing the knowledge necessary to support development of regional reclamation targets as well as site- and mine-level objectives.

2.2.2 *2010/11 Projects*

Assessment of Safety Concerns Related to Tree Planting on Active Tailings Dams

Performer: BJH Engineering

Status: Completed; report released

Expenditure: $0 (Invoice to be processed in April)

Next Steps: None planned at this time

Dam safety concern over the planting of trees and woody shrubs is in conflict with progressive reclamation, which is also a desirable outcome for oil sands tailings dams. International dam safety practice commonly restricts trees and woody shrubs on the downstream slopes of dams to preclude damage to drains, aggravation of seepage and piping and to ensure the integrity of both visual and instrumentation monitoring which require access and clear sight lines.

To address this issue, Alberta Environment (AENV) requested the Oil Sands Research and Information Network (OSRIN) to convene a third-party Task Force to provide independent opinion and recommendations on the subject.

The Task Force met in December 2010 and has recommended that provision for trees and woody shrubs on the slopes of active oil sands tailings dam shall be considered part of the responsibility of the Engineer-of-Record and plans will be submitted to AENV, Dam Safety for approval. The Task Force appreciates that it will be customary for the Engineer-of-Record to consult with corporate reclamation specialists for input into the recommended tree and shrub planting zones and tree and shrub exclusion zones. Potential exclusion zones include local critical areas such as drains, liners, berms, drain outfalls, ditches, access ramps and adjacent to instrumentation, etc.

Conducting a Dialogue 'Challenges and Timelines in Reclamation and the Feasibility of Alternative End Land Uses'

Performer: Innovation Expedition Consulting Inc. (Jones, Forrest)

Status: Completed; two reports were prepared: a short version (report only) and a long version (report plus appendices)

Expenditure: $57,604.22

Next Steps: Held a separate dialogue in November 2010 focused on equivalent land capability (see next project)

The report provides a high level summary of the conversations and discoveries that emerged over the course of the Reclamation Challenge Dialogue. During the first two months of 2010, OSRIN explored the idea of the dialogue with a number of key stakeholders who were either directly involved in or affected by the oil sands reclamation challenge. These discussions confirmed the value of holding such a dialogue and provided guidance on what particular challenges were most important to focus on.

Over 100 participants across the oil sands reclamation community of interest and practice were invited to respond to the Challenge Paper. Feedback was received from 43 individuals, including responses from governments, individuals working with First Nations in the oil sands area, academia, consulting firms, oil sands companies, research/technology agencies and nongovernment organizations. Many responded in considerable detail; over 100 pages of feedback were compiled unattributed into a Consolidated Feedback Document. This material was then synthesized into a Progress Report supplemented by a detailed Progress Report Appendix. Both the original feedback and the Progress Report material contain a wealth of information that can and should be capitalized on further.

While the Challenge Paper intended to focus on a few key aspects of the reclamation challenge for mining in the oil sands area, it ended up provoking a wide range of reactions across almost the full spectrum of the "oil sands reclamation system." The nature and depth of the responses underscored the complexity, diversity and interconnectivity of the numerous reclamation issues and opportunities presented. The responses also indicated the degree to which stakeholders wanted to express their views on these challenges. It was obvious that the respondents put considerable effort into articulating thoughtful feedback. These were not just subjects of professional interest but were matters that evoked strong, passionate feelings. Clearly there are some strongly held but also widely divergent beliefs on certain topics.

All of this feedback and its synthesis informed the design of the June 17th Workshop, held at the University of Alberta in Edmonton and attended by 38 people. The workshop was supported by a Workshop Workbook. The results of the workshop were summarized in a Workshop Synopsis document that was distributed in early September 2010.

Based on the feedback to the Challenge Paper the Workshop scope was narrowed to create a systems view of oil sands reclamation with a particular focus on key components: (1) challenges related to the rationale and application of the equivalent land capability concept; (2) challenges

related to end land use selection; and (3) challenges related to how to respond to and inform the public's expectation of reclamation success.

Two different approaches of developing a reclamation system "map" were tested with Workshop participants.

Eleven recommendations were developed from the ideas generated by the Challenge Dialogue process.

Equivalent Land Capability Workshop

Performer: Klohn Crippen Berger (Polet)

Status: Ongoing; final report in April 2011.

Expenditure: $4,930.54 (final invoice expected in 2010/11)

Next Steps: None planned at this time.

As a follow-up to our commitment from the OSRIN Reclamation Challenge Workshop held in June, OSRIN, in partnership with Dr. David Chanasyk (UofA Renewable Resources) held a one-day workshop to discuss Equivalent Land Capability for Oil Sands Mines. Why did we do this? Equivalent Land Capability is the foundation of reclamation in Alberta. However it was abundantly clear from the Reclamation Challenge process that there is a wide diversity of views on what it means and how it is applied to oil sands mines. While we didn't think we would reconcile all views into a unified vision for reclamation in a one-day workshop, we strongly believe that there is considerable value in facilitating discussion to promote understanding of the different views.

Oil Sands Terrestrial Habitat and Risk Modeling for Disturbance and Reclamation

Performer: FORRx Consulting Inc. (Welham)

Status: Phase I report released; Phase 2 underway

Expenditure: Phase 2 – $70,000 (grant)

Next Steps: Fund Phase 3 of the overall program, depending on Phase 2 results and continued commitment from Alberta Environment.

The objective of this project is to develop a framework that integrates risk management and strategic decision-making in order to evaluate the impact of disturbance (natural and industrial) on ecosystem products and services, and on habitat availability for terrestrial species in Alberta's Lower Athabasca planning region. This will include an evaluation of the impact of disturbance (including natural disturbance due to insect outbreaks, fire and wind, and industrial and agricultural disturbance), conservation, and reclamation activities associated with oil sands development both at the lease and regional levels.

Four scenarios will be incorporated into the analysis. Scenarios include a base case, climate change, mine development plans, and regional development plans. The base case scenario is a series of outcomes derived with no consideration for future climate change. The importance of the base case is that it represents the null condition and thus provides a context for comparing the relative impact of different climate change scenarios. Data for the base case scenarios are derived from historical climate records. A significant component of the work conducted in Phase I will represent the base case scenario.

Reclamation Alternatives Dialogue Assessment and Design

Performer: Innovation Expedition Consulting Inc. (Jones, Forrest)

Status: Completed February, 2010 (results included in the reports from the *Conducting a Dialogue 'Challenges and Timelines in Reclamation and the Feasibility of Alternative End Land Uses'* project)

Expenditure: $2,299.25 (final invoice not received and processed until fiscal year 2010/11)

Next Steps: Proceed with the Challenge Dialogue

This project was intended to engage a cross section of academic, regulatory, and operational reclamation planners and practitioners from industry in reaching alignment over what objectives are appropriate from a technical perspective. Part of that alignment would involve a shared understanding of what successful reclamation would look like and what we need to be able to do to achieve success. With this agreement in hand, we would then move on to identify the knowledge gaps that need to be addressed to achieve this objective.

This part of the project included preparation of a Challenge Dialogue paper, solicitation of feedback from stakeholders and revision of the paper in preparation for the workshop (see the project *Conducting a Dialogue 'Challenges and Timelines in Reclamation and the Feasibility of Alternative End Land Uses'*).

Soil Nitrogen Indicators for Land Reclamation Policy Development for Forest Ecosystems in the Oil Sands Region of Alberta

Performer: Dr. Scott Chang, Department of Renewable Resources, University of Alberta

Status: Completed; final report to be released through the Cumulative Environmental Management Association and Alberta Innovates – Energy and Environment Solutions

Expenditure: $0 (grant funds allocated in 2009/10)

Next Steps: None at this time

The lack of understanding of possible relationships between soil nitrogen (N) availability indices and forest productivity in the oil sands region of Alberta may adversely affect reclamation practices and the development of reclamation policy for the region. This project was designed to

investigate the foregoing relationships on natural, undisturbed stands and to recommend the best soil N availability indicators to use to evaluate soil N for achieving the maximum site productivity and for long-term monitoring of soil and vegetation performance in the region.

Soil N availability indices evaluated in this project included several common field-based methods (available mineral N concentrations, in-situ N mineralization rates, potential N availability measured using the plant root simulator (PRS) probes) and laboratory-based measurements (extractable N, aerobic and anaerobic N mineralization rates). We attempted to correlate the above soil N availability indices with several forest productivity indices of three of the most common native tree species in this region. The measured forest productivity characteristics include foliar size of trees, annual tree growth ring width, and aboveground net primary productivity (ANPP). The results of our research showed that most N availability indices were correlated with productivity measurements in jack pine (*Pinus banksiana*) stands, while few N availability indices were correlated with productivity indices in trembling aspen (*Populus tremuloides*) and white spruce (*Picea glauca*) stands.

Based on those results, we conclude that jack pine forest productivity is most likely limited by N availability and thus there are tight relationships between many soil N availability indices and forest productivity; while for aspen and white spruce stands, factors controlling forest productivity may be more complex (such as co-limitation of water availability) and thus there are poor N availability-productivity relationships. We recommend that for jack pine stands, laboratory based aerobic and anaerobic mineralization rates are the most cost effective methods for measuring N availability while for aspen and white spruce stands the in-situ N mineralization rate is likely the most appropriate method to determine soil N availability, as that index gave the best relationship with stand productivity.

While this study helps to determine which method of measuring nitrogen availability is most appropriate for potential input to the land capability classification system (LCCS) for soil nutrient regime assessment, further research is need to evaluate the relationship between N availability indices and LCCS classes or reclamation performance, as the current project was conducted in natural forests and extrapolating into reclamation areas will be difficult without calibration between natural and reclamation sites; the natural sites in this study were used as an analog for future developed forest stands in the reclaimed area in the oil sands region.

Support Wetland Reclamation Conference

Performer: PeatNet (Vitt)

Status: Conference held March 25 – 27, 2010; report being prepared.

Expenditure: $0 ($10,000 to be spent in 2011/12)

Next Steps: None

OSRIN committed funding to support publishing the Wetland Reclamation Conference papers.

What Constitutes Success for LFH Salvage and Replacement

Performer: Dr. Anne Naeth, Department of Renewable Resources, University of Alberta

Status: Started in February 2011; final report due by December 2011.

Expenditure: $0 (Grant to be processed in April)

Next Steps: Depend on results of the project. One potential logical progression would be to determine value for money for each of the methods and their respective success factors.

The Oil Sands Research and Information Network (OSRIN) and the coal mining sector have commissioned a literature review that will summarize the expected benefits of using LFH surface soils for forested land mine reclamation over traditional reclamation soil mixtures (e.g., peat, peat:mineral, peat:tailings sand, and peat:mineral:overburden in the oil sands and topsoil/subsoil mixtures in mountain/foothills coal mines etc.).

Based on research results documenting the benefits of using LFH in oil sands reclamation, Alberta Environment and Alberta Sustainable Resource Development recently attended three oil sands mine Energy Resources Conservation Board hearings and requested that industry be required to use soil luvic, fulvic and humic (LFH) materials for reclamation. Justification for the request was that using natural surface soil materials, rather than constructed ones, would provide a better environmental outcome after reclamation. This approach would be consistent with soil salvage and replacement approaches used on most other Alberta industrial sites. It is reasonable to assume that, in the near future, coal mines will be asked to undertake a similar LFH based salvage and replacement approach.

There is currently no clear and accepted description of what constitutes a better environmental outcome with LFH based reclamation. There is currently no clear documentation of what successful LFH based reclamation would look like, and why it would be different from success achieved from mine reclamation practices using traditional soil salvage and replacement methods. Concern has been raised that the benefits of LFH based reclamation may be short lived, and thus in the long term not be an economical or environmentally sound basis for implementation.

Woody Debris Field Guide

Performer: Dr. John Spence, Department of Renewable Resources, University of Alberta

Status: Final report due by July 2011

Expenditure: $14,850.00 (Grant)

Next Steps: None planned

Woody debris is a critical, but often overlooked, component of forest ecosystems. Its high variability provides critical habitat for a host of organisms, contributes to nutrient cycling, and has unique potential for assisting with reclamation and access management efforts in Alberta. This project will result in development of a *Woody Debris Management Guide* for Alberta oil

and gas operators to facilitate extension of research results to on the ground users. The guide will focus on providing resource managers and contractors with tangible information to be used in construction and reclamation efforts. In particular, the extension project aims to set woody debris targets and provide examples of current best practices for managing woody debris. Consideration will also be given to current policies in Alberta that dictate how woody debris is to be managed. Following completion of this extension project, companies will have up to date information that can be used to plan and deliver exploration and other development programs in a cost effective manner.

2.3 Monitoring Ecosystem Impacts

2.3.1 *Objective*

This program focuses on components of a comprehensive, robust system in Alberta to monitor the effects of oil sands mining operations on ecosystem health – a system that is scientifically sound and has the confidence of the general public.

2.3.2 *2010/11 Projects*

Dialogue on Monitoring and Information Reporting Adequacy

Performer: Congruent Strategies (James, Vold)

Status: Completed; two reports were prepared: a short version (report only) and a long version (report plus appendices); the reports were cited in the report and recommendations of the federal government's monitoring panel.

Expenditure: $66,858.28

Next Steps: None

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

Evaluation of Community Level Physiological Profiling as a Means of Assessing Aquatic Ecosystem Health in the Oil Sands Region

Performer: Alberta Innovates – Technology Futures (Davies, Eaton)

Status: Completed; report released.

Expenditure: $23,000.00 (grant)

Next Steps: Potential field trial

Alberta Innovates – Technology Futures (AITF) conducted a review of microbial Community Level Physiological Profiling (CLPP) as a means of monitoring aquatic ecosystem health for the Oil Sands Research and Information Network (OSRIN). Relevant research was compiled from journal articles, the websites of government and non-governmental organizations, and in-house experimental results. The objective of the project was to better understand and describe the potential for CLPP to provide meaningful assessments of aquatic ecosystems in the oil sands region of Alberta to various stakeholder groups.

Ecological monitoring techniques are used to assess the effects of industrial development in the region, and to assess the effectiveness of reclamation efforts. Current techniques, while effective, are difficult and expensive to implement on a regional scale. As a group, microbial community profiling technologies offer the potential to screen multiple systems rapidly, inexpensively, and relatively easily, compared to traditional assessment methods.

CLPP has the potential to be the easiest and least expensive microbial profiling technology. However, some technical advances must still be made before its full potential can be realized. Beyond this, a significant body of background information regarding the effect of a number of environmental variables on the profiles produced by CLPP must be compiled, both as a source of reference information and to better define the performance characteristics of the assay.

A number of organizations conduct ecological research and/or monitoring in the region. Some (e.g., RAMP, AENV) could see direct benefits from the incorporation of CLPP into their operations. Others (e.g., CONRAD, CEMA) may realize a lesser degree of benefit. Organizations focussing on specific aspects of aquatic ecosystems (e.g., DUC, DFO) are unlikely to see their missions advanced by the adoption of CLPP as an ecological monitoring tool.

Overall, AITF recommend investment of time and resources into CLPP and microbial community profiling in general. The expenditures required are likely to be relatively small compared to the potential utility of the technology.

Inventory and Characterize the Monitoring and Reporting of Oil Sands Environmental Health

Performer: EO Consulting (Lott, Jones)

Status: Completed; report released

Expenditure: $27,016.18

Next Steps: None

There is a general lack of awareness of existing environmental effects monitoring programs for the mineable oil sands region. As a result, there is low public confidence in the nature and extent of the current environment health monitoring and reporting programs for the oil sands with

respect to potential impacts of these developments on environmental and human health. The purpose of this study was to engage four main environmental effects monitoring and reporting organizations currently operating in the oil sands area to document their programs. Through an engagement and validation process, program information was tagged, inventoried and characterized.

Each of these organizations is unique; they all play specialized roles in providing information, data and understanding of ecosystem effects. These organizations also provide vital monitoring information based on their media, or domain expertise that is essential to understanding the ecosystem health and human health of the oil sands area.

The resultant information was captured and presented in the form of a one-page visual Summary of Environmental Effects Monitoring in the Oil Sands Area. Additional contextual information adds to the understanding of the current state and is presented as a Chronology of Environmental Effects Monitoring Activities (1990-2010).

Detailed Fact Sheets are provided for each of the four monitoring programs:

- Alberta Biodiversity Monitoring Institute (ABMI)
- Cumulative Environmental Management Association (CEMA)
- Regional Aquatic Monitoring Program (RAMP)
- Wood Buffalo Environmental Association (WBEA)

The report concludes by making some observations of the programs studied. The recommendations presented represent possible next steps to build on this body of work. The central observation and recommendation is that stakeholders, including the monitoring program staff themselves, lack a detailed understanding of the full suite of monitoring activities taking place in the oil sands area and in moving forward, a more integrated approach would benefit both the existing environmental effects monitoring programs and the ability to speak authoritatively about oil sands ecosystem effects as a whole.

Isotope and Geochemical Tracers for Finger Printing Process-Affected Waters in the Oil Sands Industry

Performer: Alberta Innovates – Technology Futures (Gibson)

Status: Completed; report released.

Expenditure: $0 (grant funds allocated in 2009/10)

Next Steps: Depending on discussions with Alberta Environment, additional field work may be undertaken.

A pilot study was conducted by Alberta Innovates – Technology Futures during 2009 and 2010 to assess potential for labelling process-affected water from oil sands operations using a suite of isotopic and geochemical tracers, including inorganic and organic compounds in water. The

study was initiated in response to a request from Alberta Environment and grant funds for the project were obtained from the Oil Sands Research and Information Network, University of Alberta. Three oil sands operators participated in the study, providing logistical support and/or personnel to assist with on-lease water sampling. Alberta Environment and its consultants also provided support for sampling of groundwater. At the outset of the study, Worley Parsons was subcontracted to carry out a detailed electromagnetic survey of the Athabasca River from Fort McMurray to the confluence of the Firebag River, to map high conductivity seeps as potential targets for water sampling. While the priority of this first phase of the study was fingerprinting of water sources (i.e., tailings ponds vs. natural groundwater, lakes, and river water), the survey also sampled a selection of river bed seeps to test application of the methods to identify the origin of these waters near the point of discharge to the Athabasca River.

In total 39 samples were collected for this study. These included 8 process-affected water samples, 6 groundwater samples, 8 river bed seepage samples, and 15 river samples. A variety of isotope tracers were measured including oxygen-18 ($\delta^{18}O_{H2O}$) and deuterium ($\delta^{2}H_{H2O}$) in water, enriched tritium ($e^{3}H$) in water, carbon-13 in dissolved organic carbon ($\delta^{13}C_{DOC}$), carbon-13 and carbon-14 in dissolved inorganic carbon ($\delta^{13}C_{DIC}$, ^{14}C), sulfur-34 in dissolved sulfate ($\delta^{34}S_{SO4}$), chlorine-37 in dissolved chloride ($\delta^{37}Cl$), and strontium-87 versus strontium-86 ($^{87}Sr/^{86}Sr$) and boron-11 ($\delta^{11}B$) in dissolved solids. Geochemical analyses included major-, minor- and trace elements, a range of metals, nutrients and total organic carbon, as well as 113 priority pollutants and naphthenic acids. Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS) was also used to scan for thousands of organic compounds in the water samples.

Overall, while selected isotopic and geochemical tracers were found to be definitive for labelling water sources in some locations, it is unreliable to attempt any universal labelling of water sources based solely on individual tracers or simple combinations of tracers. Understanding of the regional hydrogeological system, and interpretation of tracer variations in the context of a biogeochemical systems approach on a case by case basis offers the greatest potential for comprehensive understanding and labelling of water source and pathways. While limited in number of samples, the survey demonstrates the complimentary use of various fingerprinting techniques.

Preliminary evaluation of statistical approaches for differentiating various water types using inorganic, organic and combined datasets yielded promising results. These methods potentially offer multiple lines of evidence for fingerprinting and should be further evaluated, refined and applied as part of more comprehensive future investigations.

While organic and inorganic tracers were capable of fingerprinting process-affected water sources from different operators, identification of seep sources along the Athabasca River was much more challenging due to presence of complex water mixtures including groundwater and significant river water. The presence or absence of process-affected water in seeps along developed portions of the river remains to be verified and will require further baseline surveys.

FT-ICR MS offers capability to resolve thousands of organic compounds, and may be the simplest, most cost-effective approach to build a baseline dataset for use in identification of process-affected waters in the natural aquatic environment. A wide range of organic compounds are observed in process-affected water and these are not limited to naphthenic acids and hydrocarbons.

Further work to constrain sources, pathways and receptors of process-affected water needs to be undertaken. From a riverine perspective, synoptic surveys offer an integrative method for better understanding of evolution of the Athabasca River and tributaries as it may be affected by addition of both natural and potentially process-affected water.

We find no evidence of robust connections between tailings ponds and the river seeps that were sampled over the 125-km reach traversing the oil sands development area, although many seeps were not sampled. Although the seeps we did sample appear to be directly related to occurrence of natural groundwater seepage, we do not have enough evidence at this point to rule out the possibility that minor or trace amounts of process-affected water may be present in some of these seeps.

2.4 Increasing Awareness

This program aims to increase awareness of OSRIN and oil sands issues through an active website presence (www.osrin.ualberta.ca), sponsoring oil sands related conferences, digitizing historical information and publication of OSRIN research results.

2.4.1 *2010/11 Projects*

Conference Sponsorship

Performer: OSRIN committed funds to various conferences

Status: ongoing

Expenditure: $13,000.00

Next steps: Identify additional conferences to support

OSRIN provides support to conferences and other venues to ensure that there are opportunities for practitioners to access oil sands information.

Develop Website Structure

Performer: James Murgatroyd Communications (James Murgatroyd)

Status: Web design completed. OSRIN used the design concepts, but chose to shift our website to the University of Alberta platform. The website was released in August and formally announced in September 2010 – http://www.osrin.ualberta.ca/

Expenditure: $34,774.74

Next Steps: Maintain website content (internal staff costs)

The web designer converted the web portal design into a functioning website.

Digitize Historical Research Project Reports

Performer: OSRIN staff, with significant assistance from the University of Alberta Libraries

Status: RRTAC report digitization completed; AOSERP report digitization underway; Government of Alberta report digitization underway

Expenditure: None

OSRIN digitized historical oil sands related government-sponsored research work from the Alberta Oil Sands Environmental Research Program (57 reports) and the Reclamation Research Technical Advisory Committee (39 reports) and placed them on the University of Alberta's Education & Research Archive website to make information more readily accessible to stakeholders. These reports provide context and, in the case of the AOSERP reports considerable baseline information, to help stakeholders appreciate the depth and breadth of research undertaken since the mid-1970s to understand oil sands impacts and develop appropriate mitigation. Other Government of Alberta reports are also being digitized to provide additional context.

iGEM Award Sponsorship

Performer: ConocoPhillips Canada (on behalf of the Oil Sands Leadership Initiative)

Status: Completed; see the OSLI New Ideas website for details of the competition

Expenditure: $25,000.00 (grant)

Next Steps: Consider sponsorship of 2011 competition

OSRIN contributed $25,000 to sponsor awards for participating teams in the oil sands competition within the overall iGEM competition. OSLI provided $100,000 to the award pool.

iGEM UofA Team Sponsorship

Performer: Dr. Mike Ellison, University of Alberta

Status: Completed; see the OSLI New Ideas website for details of the competition

Expenditure: $5,000.00

Next Steps: None

OSRIN provided the University of Alberta team $5,000 to support their travel to, and participation in, the iGEM competition.

Innovation Asset Database

Performer: UofA MBA Students (Cheruvathur, Hansdah)

Status: Completed; included as part of OSRIN's website (http://www.osrin.ualberta.ca/Resources/WhosWho.aspx)

Expenditure: Staff costs

Next Steps: Maintain database

Two MBA students prepared a searchable database of people working on oil sands land reclamation. The contents of the database were placed on the OSRIN website.

2.5 Social, Economic and Regulatory

This program seeks to identify social, economic and regulatory issues that may affect oil sands reclamation and to evaluate the effectiveness of reclamation in addressing social, economic and regulatory issues.

2.5.1 *2010/11 Projects*

Accounting for Environmental Liabilities under International Financial Reporting Standards

Performer: Dr. Thomas Schneider, University of Alberta

Status: Completed; report released

Expenditure: $11,960.00

Next Steps: None

Recent reports from environmental non-governmental organizations (ENGOs) such as the Pembina Institute and the Environmental Law Centre in Canada, as well as investor groups such as Ceres and The Ethical Funds Company, have addressed the growing concern over environmental liabilities related to operations in Alberta's oil sands (Lemphers et al. 2010, Reuter et al. 2010, The Ethical Funds Company 2008, Watt 2010). Furthermore, environmental obligations are beginning to take a real bite out of the financial statements of firms operating in this sector. For example, a recent Globe and Mail article (Taylor 2010) on the owner of the largest single share in the Syncrude operation, Canadian Oil Sands Trust, notes that the almost $1 billion in spending next year it has allocated to its plants are primarily for moving equipment around and meeting environmental obligations, rather than improving plant efficiencies (Canadian Oil Sands Trust 2010).

Concurrent to this is a change in the accounting rules for Canadian public companies. Canadian public companies are in the process of moving from reporting under old Canadian Generally

Accepted Accounting Principles (GAAP) to International Financial Reporting Standards (IFRS), which is now officially Canadian (public company) GAAP. This transition must take place for fiscal years ending after December 31st, 2010; which means that the first quarter financial reports for 2011 will be based on IFRS. This will include comparative information as it pertains to 2010.

With the move to IFRS, one of the key areas affecting firms in extractive industries pertains to the accounting rules by which environmental liabilities are accounted for. For firms in these industries, environmental matters play a major role in operations. The change in accounting rules will have a material effect on the total amount of environmental liabilities reported and the way in which they are expensed over time. The researcher expects that under IFRS, more environmental liabilities will be recognised in the financial statements of firms operating in extractive industries, such as oil and gas and mining. However, there are certain mitigating factors that may be strong enough such that we see no significant increase in the reported environmental liabilities of these firms. The actual settling of these liabilities will occur in the coming decades. Under old Canadian GAAP and IFRS, these liabilities are recognised in the financial statements based on their present value. This is typically done by using a discount rate and the usual methods of calculating the present value of a future obligation. The new IFRS rules are very sensitive to the discount rate used and there is some debate as to exactly how the new discount rate should be calculated. Thus, although the new accounting standards under IFRS dictate that more specific environmental liabilities be recognised in the financial statements, this may be offset by changes in the way that they are quantified. This report discusses the potential impact the move to IFRS is expected to have on firms with mining operations in Alberta's oil sands. It details the changes in accounting methods and the potential impact on these firms with regards to the reporting and expensing of environmental liabilities. The discussion can be generalized to the overall oil and gas and mining sectors. However, the significant environmental challenges that are faced by the handful of firms mining in Alberta's oil sands make the move to IFRS an interesting one to follow.

DCM Survey of Albertan's Value Drivers

Performer: Cambridge Strategies Inc. (Das)

Status: Completed; report released.

Expenditure: $60,000.00

Next Steps: Cambridge Strategies and OSRIN will work with interested parties to further explore the details of the study and the implications to their various businesses.

A random sample of 1,032 Albertans, aligned with the Statistics Canada 2006 demographic profile of the Province of Alberta, completed an on-line survey with two elements: a conjoint best-worse survey, and a set of attitudinal questions. The goal of the CSI-OSRIN Oil Sands Survey (the survey) was to gather empirical information as a basis for oil sands policy development for both industry and government.

In contrast with conventional opinion polling, conjoint surveys force respondents to make trade-offs among sets of alternatives. The choices available in the alternatives presented are randomly generated by a computer program, and presented several times in different combinations. The consistency and tenacity with which respondents make certain choices over others enables the conjoint survey to determine the core values and principles that are most important. To think of it another way, the top choices become the essence of both a social license to operate for industry and the consent of the citizenry to be governed. In effect, they indicate which aspects of oil sands stewardship and development are most negotiable, and which are least negotiable, when it comes to responding to the public's expectations.

Compared with conventional opinion polling, a conjoint survey is a more accurate indicator of actual preferences and a more precise determinant of behaviours. The survey therefore identifies the priorities of perceived values, performance and aspirations around responsible and sustainable oil sands development. We hope this survey can be an empirical foundation of any public policy design, development and deployment regarding the oil sands. The results offer a clear understanding of public expectations.

The survey found that the top three drivers related to development and reclamation of oil sands were: Type of reclamation (20%), Wildlife habitat (19%) and Ecological monitoring (18%). There is significant consistency in priority choices between these 2010 survey data and a similar study CSI conducted in 2007 (Chapman et al. 2009) on the values and priorities of Albertans with regard to responsible and sustainable oil sands development. Based on the priority preferences as to what should guide and drive oil sand development this survey result shows where action is needed and communications should be focused.

The survey then looked at how Albertans perceive issues are being addressed.

- For the **type of reclamation** driver 31% believe that the focus is on reclamation to sustain wildlife and biodiversity while 23% believe it is to return land to a "state of nature". Surprisingly 21% believe that reclamation is about letting nature take its course (i.e., no reclamation).
- For the **wildlife habitat** driver 78% believe that there is some wildlife habitat protection when developing oil sands, 16% believe there is no protection and 6% believe there is full protection.
- For the **monitoring ecological impacts** driver 47% of Albertans believe government is doing the monitoring, 36% believe industry is and 11% thought it was done by a third-party. Only 6% felt there was no monitoring done.

Perceptions around reclamation indicated that Albertans expect government to set the rules, regulations and define best practices for reclamation and the companies operating in the oil sands should then take the lead for reclamation responsibilities. 78% of survey participants completely agreed or agreed with this position, while 16% slightly agreed. Only 6% disagreed with this to one degree or another.

When asked if companies operating in the oil sands should be solely responsible for reclamation the survey found that 69% of participants completely agreed or agreed with this position and 16% slightly agreed. There were 15% who disagreed with this position to some degree or other.

When queried if oil sands companies should be held liable for all environmental damages caused by their operations the survey found 87% completely agreed or agreed with this position, 9% slightly agreed and only 4% had some level of disagreement with this approach.

When asked about perception on how well the Alberta government is responsibly managing the oil sands resource 31% agreed or completely agreed they were doing the job and 18% disagreed or disagreed completely. There was a significant swing group of 51% in the middle – 34% who slightly agreed the government was responsibly managing the oil sands and 17% slightly disagreed.

Most of the choices people identified as important to them coincide with the current state of oil sands development and management. However there were some key attributes where there was a clear difference. These attributes represent the areas where government and industry risk loss of the social licence to operate unless further work is done to address the misalignment between what people perceive is happening and what is actually happening. Work in these areas could include better communication of the current state and why it is appropriate or what is being done to correct the current state if it is inappropriate.

Plain Language Summary Explanation of Human Health Risk Assessments

Performer: Dr. Mohamed Gamal El-Din, University of Alberta

Status: Ongoing (will be completed in 2011/12)

Expenditure: $12,000.00 (grant)

Next Steps: None planned at this time

Human Health Risk Assessments (HHRA) form an important part of oil sands mine Environmental Impact Assessment reports and are likely to be a key requirement in any future requests to release process-affected waters to the environment. HHRAs are very complex and therefore difficult for lay people (general public and Aboriginal communities) to understand. Therefore there is a need for a summary, in plain language, explaining what Human Health Risk Assessments are and how to interpret the results arising from one, with particular emphasis on oil sands mine HHRAs.

An extensive literature survey will be conducted to collect relevant information on the following subjects:

- Description of HHRAs;

- Why HHRAs are prepared and by whom they prepared;
- What are the benefits of conducting HHRAs and how they could be utilized;
- How HHRAs are prepared;
- The different forms of HHRAs outputs;
- Interpretation of HHRAs outputs and how they can be utilized; and
- Glossary of important terms used in HHRAs.

Review of Health Effects of Naphthenic Acids

Performer: Dr. Warren Kindzierski, University of Alberta

Status: Ongoing (will be completed in 2011/12)

Expenditure: $18,000.00 (grant)

Next Steps: None planned at this time

Human Health Risk Assessments (HHRA) form an important part of oil sands mine Environmental Impact Assessment reports and are likely to be a key requirement in any future requests to release process-affected waters to the environment. Oil sands mining involves removal of water from the Athabasca River. Water produced during the extraction of bitumen from oil sands is referred to as process-affected water. Naphthenic acids are solubilized and concentrated in process-affected water and are likely to be an important part of any HHRA related to discharging process-affected waters. OSRIN has commissioned a literature review describing the known health effects of naphthenic acids and how this information is incorporated into HHRAs (e.g., pathways, effects, required doses, whether they treated as carcinogenic or non-carcinogenic, etc.).

2.6 Strategic Design

This program includes projects to help OSRIN establish and document its strategic intent, and research and communication approach. The products form the key tools to explain who we are and what we do.

2.6.1 *2010/11 Projects*

Communications Strategy Support

Performer: Redoaks Management Consulting Inc. (Simpson)

Status: Provided initial support/advice.

Expenditure: $4,400.00

Next Steps: None

Redoaks Management was contracted to provide:

- Strategic orientation of web site
- Communications input and guidance with the Challenge Dialogue and subsequent reports
- Assistance with letters or documentation relating to the Oil Sands Research and Information Network (OSRIN) consultation with a variety of interest groups

3 FINANCIAL STATUS

3.1 Revenue

During 2010/11 OSRIN gained $20,217.50 through contracts for work undertaken by the Executive Director and direct contributions to support OSRIN and/or specific projects.

3.2 Expenditure

In 2010/11, OSRIN spent $853,717.93 (broken down by program area and administration in the table below).

Cost Centre	$ Spent[1]	% of Total $ Spent
Tailings Reclamation	$75,068.23	8.79
Regional Landscape Reclamation	$155,395.57	18.20
Monitoring Ecosystem Impacts	$119,565.94	14.01
Increasing Awareness	$78,649.28	9.21
Social, Economic and Regulatory	$102,950.00	12.06
Strategic Design	$6,307.00	0.74
Administration[2]	$315,781.91	36.99
TOTAL	$853,717.93	

[1] Includes grants, purchase orders, invoices and expenses related to projects.

[2] Includes salaries, and travel and expenses for OSRIN staff

Section 2 summarizes expenditures by project and Appendix 4 provides more details.

3.3 Remaining Budget

At the end of March 31, 2011, total OSRIN expenditure since 2008 was $2,160,847.89. An additional $52,453.46 in outstanding commitments leaves an uncommitted balance of $2,579,180.73 which is available for future research work and to cover overhead.

4 FUTURE RESEARCH

OSRIN will continue to fund projects in the first five program areas during 2011/12, based on the results of current projects, advice from the Board of Directors, and discussions with other funding and research management agencies. OSRIN does not foresee work in the Strategic Design program area in 2011/12.

OSRIN notes the continuing emphasis on tailings and monitoring in the media and public policy arenas and will focus work in those areas to support regulators and industry and to improve public awareness. OSRIN will also undertake several projects related to the provincial government's recently announced Mine Financial Security Program.

Every effort will be made to co-fund projects with partners, likely by co-funding work of others. In some cases OSRIN may decide the issue is important enough that it should fund the work on its own; however, each case will be carefully examined to ensure the Board of Directors agrees the project will add value.

APPENDIX 1 – OSRIN Strategies

OSRIN is pursuing four main strategies.

1. Strategic Knowledge Synthesis
2. Research
3. Communications
4. Organizational Sustainability

Strategy 1 – Strategic Knowledge Synthesis

The Strategic Knowledge Synthesis strategy involves the following five step process

- Issue Identification: Identify the key questions or challenges. These may be challenges confronting regulators as they pursue the goal of ensuring that that reclaimed post-mining landscapes meet Provincial objectives. They may be challenges confronting companies as they seek to most effectively reclaim landscapes.
- Scoping Study to define state of knowledge and critical gaps: Commission and oversee scoping studies to define state of knowledge. In most cases, this will involve retaining a consultant with significant experience in the issue area. The scoping study will involve identifying and synthesizing existing knowledge, identifying the key people engaged in addressing the issue, and acquiring and summarizing the important literature. A preliminary identification of knowledge gaps is an important product of the scoping study.
- Expert Validation: Circulate the draft scoping study to an independent panel of experts for reaction and comment. The experts would include academics, and personnel from industry and government. This stage may involve a workshop to bring the expert panel together to arrive at alignment on the state of knowledge, knowledge gaps and to identify areas where the experts agree to disagree. Part of this process will involve definition of a research agenda to address the knowledge gaps.
- Publication of study and action plan to respond to gaps: Publish the findings of the scoping study and the expert panel conclusions.
- Promotion of R&D program to address gaps: Engage potential funding partners in developing an R&D program to address the remaining knowledge needs.

Strategy 2 – Research Strategy

OSRIN is defining knowledge gaps in terms of barriers to taking action. (1) If policy and or operating organizations lack the knowledge of how to proceed, a gap exists. (2) If it is clear how to proceed, but there are concerns or unknown factors that may lead to unexpected and undesirable consequences of the action, a knowledge gap exists. In either case, OSRIN would develop a research program to address the knowledge gaps.

OSRIN will seek other organizations and funding sources to partner in funding an R&D project/program to address gaps. In most cases, the R&D program would be structured to

1. define clearly what expected outcomes are desired,
2. solicit statements of interest from the broad community of researchers who are interested in and capable of developing solutions to the knowledge gaps, and
3. screen statements of interest and request full proposals from teams of researchers deemed best able to provide the missing knowledge.

Strategy 3 – Communications Strategy

OSRIN's communications strategy consists of 3 elements, (1) Maintaining informal and formal contacts with key stakeholders, (2) establishing and maintaining a web portal, and (3) hosting a series of dialogues and workshops directed at developing shared understanding of key issues.

Maintaining Contacts with Key Stakeholders

To establish and maintain credibility and influence, OSRIN must be seen to be part of the community. This will involve creating, developing and maintaining regular informal contact with key individuals and organizations. It will also involve participating in organizations and processes by which knowledge is shared, processed and implemented in policy.

Web Portal

The primary element of OSRIN's communications strategy is to develop a web portal to serve as a vehicle to provide knowledge products to multiple stakeholders. We intend to explore the use of social networking tools such as Twitter, and Facebook to acquire and distribute content and to enhance traffic to the web portal.

We intend to establish partnerships with existing and emerging sites that will avoid duplication of content. OSRIN will publish on our site only those materials that are not available through existing sites. We intend to link with other resources, wherever we can find them. In some cases this may involve investing in partner sites to facilitate their maintaining complete and current archives.

Key elements of the portal will include (among others):

- A report Archive will provide, to the extent feasible, access to full text reports. OSRIN intends to bring together in one place a means of accessing all publically reports related to land and water impacts of surface mining of oil sands.
- Background papers that provide insights into the context within which oil sands development is occurring.
- Policy analysis papers that examine key questions and present alternative scenarios of potential policy options that might respond to the issues.
- A site for Dialogue around key issues. Oil sands development occurs within the context of economic, social, cultural, geopolitical, environmental, ethical and technical forces. The web portal intends to be a host for public dialogue on these

issues to facilitate Albertans in evolving their understanding of the issues and tradeoffs involved in managing the development of their oil sands resource. This area will include links to influential bloggers and columnists that are contributing to the public debate.

- Sense making, fact checking and accountability. The discussion of oil sands development involves many conflicting voices with differing agendas. Not infrequently, information is presented in differing ways to make particular points. From time to time, mis-information is published. One of the functions of the site will be to help clarify the seemingly conflicting facts and illuminate incorrect facts or assertions in the media.

Dialogues and Workshops

OSRIN intends to engage the professional community through dialogues and workshops that will explore key issues. These types of events will be especially important in seeking alignment among experts on key issues.

Strategy 4 – Organizational Sustainability

OSRIN is taking a two pronged approach to organizational sustainability. The first involves leveraging our resources to create win-win opportunities to advance our mission and help partner organizations advance their missions. The second involves actively seeking to create value for potential future investors and seeking long-term funding partnerships.

The first element of the strategy will involve seeking out opportunities to partner with organizations such as PTAC, OSLI, the Helmholtz/Alberta partnership to advance the agenda of substantial improvement in the environmental performance of oil sands mining. In many cases this will involve investing our funds outside of OSRIN to contribute to programs and projects that advance our mission.

OSRIN intends to be opportunistic in pursuing funding for projects, but not at the expense of remaining focused on our mission. OSRIN is not about capturing dollars simply to increase the budget.

OSRIN is proceeding on the basis and of the belief that if value is created for stakeholders, investors will commit to sustaining OSRIN's ability to continue to contribute. We believe that OSRIN has the greatest potential of creating value for two groups of stakeholders, (1) the Alberta Government, and (2) private foundations with a strong mandate in the energy/environment nexus. OSRIN's sustainability strategy therefore focuses on pursuing those sources of potential sustaining support.

APPENDIX 2 – OSRIN Operations

Staffing

OSRIN has operated with a minimal staff. Leadership has been provided by the full-time Executive Director.

Executive Director

Dr. Stephen Moran served as Executive Director on a term contract from March 1, 2009 to April 19, 2010. Chris Powter, formerly of Alberta Environment, became Executive Director effective April 19, 2010. Dr. Moran supported OSRIN as a strategic advisor and mentor in 2010/11.

Program Support Position

A full-time support position was created in April 2010 with an emphasis on administrative support, contract management and web support. Doug Leong filled the position from April until November; a temporary replacement was found for November to February (Caroline Simpson) and Barbara LeFort was hired in March.

Researchers

OSRIN will engage the research community in conducting research and policy analyses to address knowledge gaps and to link existing knowledge to policy issues. Researchers may come from academic institutions, research organizations or private consulting firms. Research funds may be provided in the form of grants or contracts, depending on the research provider and the nature of the work being funded.

APPENDIX 3 – OSRIN Story

What is OSRIN's Vision

OSRIN is working toward a future in which Albertans can reap the economic benefits of oil sands development without sacrificing the health of the natural ecosystem or human health.

Why OSRIN?

Albertans, as well as others across the world, are increasingly concerned about the environmental impacts of oil sands development. Alberta is investing to develop the technology and practices necessary to improve environmental performance. Alberta Environment has invested in OSRIN to address issues related to impact of oil sands development on water and land. OSRIN's role is to help Alberta "do the right thing" to ensure healthy, self-sustaining boreal landscapes after mining and processing oil sands.

What is OSRIN?

OSRIN is a university-based, independent organization that develops the best 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).

Who are OSRIN's Customers?

We provide:

- **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

Who pays for OSRIN work?

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 the Environment Ltd. We intend to seek partners and additional financial supporters with whom to collaborate in sustaining this work.

Where will OSRIN focus?

OSRIN's initial focus is on facilitating development of regulations, practice, and technology that support:

- Reclamation of oil sands tailings – reducing the footprint and impact of tailings ponds and disposal areas

- Landscape reclamation – integration of reclamation regulations with the regional land-use planning framework to return mining and processing sites to successful, self-sustaining boreal landscapes that meet citizens' expectations; this will include work on terrestrial, wetland and water body reclamation
- Identification and minimization of the effects of oil sands mining on ecosystem health

We recognize 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.

APPENDIX 4 – Detailed OSRIN Project Expenditures

The following table provides details of OSRIN's 2010/11 project expenditures.

Project	Committed	Spent 2010/11	Previously Spent	Other Expenses	Total Spent
Tailings Reclamation					
Tailings Dewatering Technology Review	$40,000.00	$39,998.64	$0.00	$2,915.56	$42,914.20
Reclamation of Dewatered Fine Tailings	$30,335.00	$30,334.30	$0.00	$500.51	$30,834.81
Mining Clean Bitumen Technology Action Plan (CBTAP)	$8,000.00	$400.00	$7,732.00	$919.22	$9,051.22
Regional Landscape Reclamation					
Reclamation Alternatives Dialogue Assessment and Design	$14,650.00	$2,299.25	$13,356.42	$0.00	$15,655.67
Conducting a Dialogue 'Challenges and Timelines in Reclamation and the Feasibility of Alternative End Land Uses'	$71,150.00	$57,604.22	$13,722.75	$4,546.86	$62,151.08
Support Wetland Reclamation Conference	$10,000.00	$0.00	$0.00	$0.00	$0.00
What Constitutes Success for LFH Salvage and Replacement	$25,000.00	$0.00	$0.00	$0.00	$0.00
Woody Debris Field Guide	$14,850.00	$14,850.00	$0.00	$0.00	$14,850.00
Equivalent Land Capability Workshop	$5,009.00	$4,930.54	$0.00	$1,164.70	$6,095.24
Assessment of Safety Concerns Related to Tree Planting on Active Tailings Dams	$15,000.00	$0.00	$0.00	$0.00	$0.00
Oil Sands Terrestrial Habitat and Risk Modeling for Disturbance and Reclamation	$70,000.00	$70,000.00	$0.00	$0.00	$70,000.00
Monitoring Ecosystem Impacts					
Inventory & Characterize the Monitoring and Reporting of Oil Sands Environmental Health	$58,800.57	$27,016.18	$32,906.58	$733.12	$60,655.88
Dialogue on Monitoring and Information Reporting Adequacy	$67,925.00	$66,858.28	$0.00	$1,958.36	$68,816.64
Evaluation of Community Level Physiological Profiling as a Means of Assessing Aquatic Ecosystem Health in the Oil Sands Region	$23,000.00	$23,000.00	$0.00	$0.00	$23,000.00
Increasing Awareness					
Conference Support	$15,375.00	$13,000.00	$0.00	$0.00	$13,000.00
Develop Website Structure	$35,700.00	$34,774.74	$0.00	$0.00	$34,774.74
iGEM Competition Sponsorship	$25,000.00	$25,000.00	$0.00	$52.18	$25,052.18
U of A iGEM Team Sponsorship	$5,000.00	$5,000.00	$0.00	$0.00	$5,000.00
Social, Economic and Regulatory					
DCM Survey of Albertans' Value Drivers	$60,000.00	$60,000.00	$0.00	$990.00	$60,990.00

Project	Committed	Spent 2010/11	Previously Spent	Other Expenses	Total Spent
Plain Language HHRA Summary	$12,000.00	$12,000.00	$0.00	$0.00	$12,000.00
Review of Health Effects of Naphthenic Acids	$18,000.00	$18,000.00	$0.00	$0.00	$18,000.00
Accounting Reporting Standards	$11,960.00	$11,960.00	$0.00	$0.00	$11,960.00
Strategic Direction					
Communications Strategy Support	$25,000.00	$4,400.00	$8,798.95	$1,907.00	$15,105.95

NOTES:

Some project costs are higher than the project commitments because:

- GST charges are not included in the Committed amount.
- OSRIN decided to fund some project costs (e.g., travel, accommodation) for some projects through invoices in addition to the funds provided directly through the purchase order.
- Some OSRIN expenses that are directly attributable to a specific project are attached to that project rather than OSRIN overhead (e.g., workshop hosting charges, travel to project meetings, travel to present project findings at a conference).

The Previously Spent column includes funds spent in 2009/10 for multi-year projects and includes contract costs as well as related expenses.

Non-project costs such as overhead are not reported here.