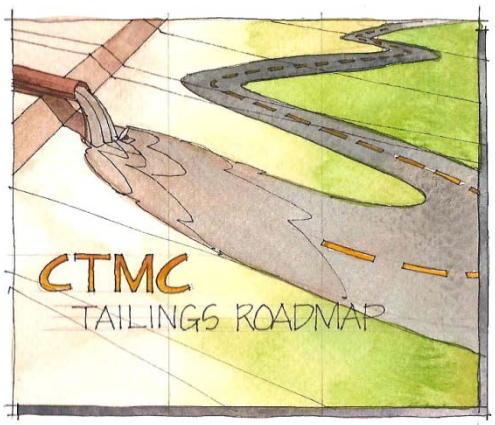

OIL SANDS TAILINGS
TECHNOLOGY DEPLOYMENT ROADMAPS

PROJECT REPORT - VOLUME 3
COMPONENT 2 RESULTS

Report

to

Alberta Innovates - Energy

and Environment Solutions

June 28, 2012

Golder Associates Ltd.
#102, 2535 - 3rd Avenue SE
Calgary, Alberta
T2A 7W5

Mr. Darcy Cowan
Project Manager

Dear Mr. Cowan:

Oil Sands Tailings Technology Deployment Roadmaps
Component 2 Report - Volume 3

We are pleased to provide the attached report of the Component 2 results for the tailings roadmap study. The report presents the results of a number of workshops and studies used to develop the objectives, sub-objectives and indicator criteria to be used to screen and develop the road map for tailings technology implementation.

This is a descriptive report and it attempts to summarize the methodology, logic and discussions within the various working meetings and workshops as part of the development of the objective criteria for this project.

We trust that this meets your requirements at this time, and we look forward to your comments on this draft report

Yours truly,
KLOHN CRIPPEN BERGER LTD.

Brett Stephens, MEngSc., MEnvEngSc., P.Eng.
Principal, Senior Geotechnical Engineer

BAS/m-ch

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Appendix I Table of Objectives/Sub-objectives versus Indicators

1 INTRODUCTION

1.1 Oil Sands Tailings Technology Deployment Roadmaps Project

The "Technology Deployment Roadmap and Action Plan for 'End-To-End' Solutions for Oil Sands Tailings" (Oil Sands Tailings Technology Deployment Roadmaps) is an initiative of both the government and industry to support a broader strategy for sustainable management of tailings produced by the oil sands industry. The Oil Sands Tailings Technology Deployment Roadmaps initiative will provide a framework to government and industry that will:

- Help achieve more timely deployment of the end-to-end tailings technologies, and share the results and knowledge of tailings deployment activities.
- Document the current state of tailings reclamation technology to define technology pathways to reach the end goal.
- Serve as a basis for accessing government and industry funding to accelerate commercial scale demonstration of technology and promote sharing and technology transfer.
- Identify technology options and establish a framework for operators to conduct detailed feasibility studies and deploy technology, and allow regulators to verify the performance during this process.
- Promote a collaborative approach to oil sands tailings technology that expedites technology deployment, reduces environmental impacts beyond the boundaries of the mine lease and enhances public trust.
- Provide a medium for sharing the results and knowledge of effective tailings deployment initiatives.

The study was completed by the Consortium of Tailings Management Consultants (CTMC) which comprises an alliance of engineers and scientists from the proponent organizations which include:

- AMEC Earth & Environment;
- BGC Engineering Inc.;
- Golder Associates;
- Klohn Crippen Berger Ltd.;
- Norwest Corporation;
- Thurber Engineering; and
- University of Alberta Geotechnical Research Group.

The project is led and managed by Golder Associates who have been directly engaged by Alberta Innovates - Energy and Environment Solutions. The remaining proponent organizations of the CTMC are sub-consultants to Golder Associates.

1.2 Study Objectives

The project has been divided into four broad components as follows:

- Component 1: Consolidate the available data, state of practice and identify all tailings technologies.
- Component 2: Develop Screening Criteria and Objectives to be used by the project for evaluation of the identified technologies.
- Component 3: Screen the tailings technologies based on the Criteria and Objectives.
- Component 4: Develop a Roadmap for the implementation of various technologies in the oil sands.

The objective of the Component 2 Study was to develop objective screening criteria to be used by the project team and government and industry stakeholders in evaluating various technologies identified as part of the study. These criteria were utilized by the Component 3 team where the evaluation and screening level appraisal of the identified technologies was completed.

The development of the screening criteria was designed to run parallel with the Component 1 element of the study which comprises the review and documentation of existing and proposed technologies for management of oil sands and other tailings. The intent of the parallel implementation was to facilitate regular evaluation of the data being collected by the Component 1 team with the screening criteria developed within Component 2.

1.3 Component 2 Project Team

The Component 2 study team comprised a small core team, covering a range of disciplines. The team included:

- Team Lead: Brett Stephens, P.Eng. Senior Geotechnical Engineer, Klohn Crippen Berger Ltd, Calgary.
- Assistant Team Lead: Bill Chin P.Eng. Senior Geotechnical Engineer, Klohn Crippen Berger Ltd, Calgary.
- Process Engineering: John Peters, P.Eng,/Chris Barringer, P.Eng., AMEC, Calgary.
- Mine Planning: Carl van Eendenburg, P.Eng., AMEC, Calgary.
- Geochemist: Steve Sibbick, P.Geol, AMEC, Mississauga.
- Closure Specialist: Dr. Gord McKenna, P.Eng., P.Geol., BGC Engineering Inc., Vancouver.

In addition to the above team, support was also provided by:

- Research Lead: Dr. John Sobkowicz, P.Eng., Thurber Engineering, Calgary.
- Component 1 Co-Team Lead: Richard Dawson, P.Eng., Norwest Corporation, Vancouver.

- Component 3 Team Leads: Sue Longo, P.Eng./Irwin Wislesky, P.Eng., Golder Associates, Calgary.
- Component 3 Assistant Team Lead: Dr. Dave Sego, P.Eng, University of Alberta, Edmonton.
- Component 4 Team Lead: Jeremy Boswell, Thurber Engineering, Calgary.

1.4 Component 2 Scope of Work

In accordance with the Project Execution Plan (PEP) for the study, Component 2 was originally divided into four separate tasks. These are described in the following sections, and have been numbered sequentially as they are referred in the PEP:

- Task 5 – Identify End Goals

The development of the end goals for this study comprised two parts:

  - Defining constraints and assumptions associated with the desired reclamation end goals.
  - Identifying the end goals for the roadmap.

- Task 6 – Identify Screening Criteria

A number of screening criteria were identified and agreed as a basis for screening of the initial comprehensive list of tailings technologies. The criteria were to be developed by a multidisciplinary team to reduce bias and provide perspective to the screening criteria with respect to the development stage of the technology, technical feasibility, reliability, ability to scale, reclamation potential, and other practical indicators for technology assessment.

- Task 7 – Identify Constraints and Opportunities

Identify any constraints in the development of tailings management solutions and any opportunities that may arise from the adoption of specific solutions.

- Task 8 – Client Workshop #1

Once the tailings management technologies are identified (Component 1) and the evaluation criteria and end goals, opportunities and constraints developed (Component 2), the full project team met with the client team and stakeholders to review and approve the Component results. This first client workshop was scheduled to be held as the Component 1 and 2 studies were being completed, with its purpose to:

  - inform the client of the information collected and the current state of information available to the project; and
  - review with the client the recommended first level of screening for the technologies to be applied for the project, and obtain agreement on these criteria.

The key objective of the workshop is to obtain agreement between the CTMC and the Client on the options and evaluation criteria. This is to prevent revision of these decisions later in the project as the later Component assessments are completed.

The actual process for carrying out the Component 2 work, however, necessarily evolved as the project progressed, as described in Section 2.

1.5 Study Methods

The work for the Component 2 study was completed as a series of workshops to discuss and develop the concepts used in the development of the End Goals, Screening Criteria and the Constraints/Opportunities. Video conferencing and conference calls were utilized to limit travel costs and allow maximum participation from the study team.

The results and times of individual workshops and meetings are discussed in further detail in the following results section of this report.

2 COMPONENT 2 RESULTS

2.1 General

It became apparent early in the Component 2 study that it was difficult to complete Tasks 5 to 7 in a separate and linear fashion. These tasks had many commonalities which resulted in overlap with respect to the discussions and results required. The resulting process would necessarily be more iterative and require the involvement of Component 3. It was decided to adopt a framework for the study that developed these tasks concurrently.

The Component 3 team was included in the workshops and discussions for Component 2 to provide a context for development of the evaluation criteria. The intent was that it would identify and consider concepts helpful for the Component 3 team, and would facilitate alignment between the Component 1, 2 and 3 teams.

2.2 Workshops

The Component 2 study team decided to complete the work for Tasks 5 and 6 as part of the initial two workshops. The intent was that the discussions for the end goals and screening criteria were linked and jointly working on these two tasks was a logical progression for the study.

Two internal workshops were held to support the development of Tasks 5 and 6. These were completed on June 30, 2011 and July 5, 2011. The initial meeting was an introductory meeting for the Component 2 team in which the background for the study was provided to the team. The objectives for the Component 2 work were discussed and arrangements made for main internal workshop for Component 2. The July 5, 2011 workshop was the key internal workshop for the development of Tasks 5 and 6.

The first client workshop for the Oil Sands Tailings Technology Deployment Roadmaps was held August 8, 2011. During this meeting the results of Component 2 discussions were presented to the client and industry representatives for discussion and further development.

A workshop for Task 7 was completed on March 9, 2012, to review potential opportunities and constraints. This workshop included participation by the Component 4 team who were most likely to utilize the results.

2.3 Tasks 5 and 6 – Development of Objectives and Sub-Objectives

2.3.1 Development Strategy

A number of themes were identified during the development of the end goals and screening criteria for the Oil Sands Tailings Technology Deployment Roadmaps. These related to how the end goals and screening criteria would frame the study in a manner that would best enable Component 3 to screen the technologies compiled by Component 1, and for Component 4 to develop the roadmap.

A key theme in the Component 2 deliberations was that the Oil Sands Tailings Technology Deployment Roadmaps should recognize the wide range of technologies and stages of development under consideration for the process. These ranged from mature technologies used in production to research level studies. Accordingly there was a strong opinion within the project team (and eventually the client representatives) that the screening criteria should not include absolute criteria (must haves) which may arbitrarily exclude technology. Through the development of these tasks, the nomenclature used to describe the end goals and screening criteria was changed to “Objectives” and “Sub-Objectives” respectively.

There was also a consensus that the traditional engineering-oriented evaluation tools for decision making (i.e. Kepner-Tragoe, etc) were overly structured to properly evaluate all technologies under consideration. These tools suffer from a number of issues which included:

- The methods utilize must-have requirements. Depending on the criteria selected, these methods may arbitrarily exclude technologies.
- The “probability of success” and “relative risks” which these methods rely is considered difficult to judge, especially across the range of different maturity of technologies, development timeframes and legacy site conditions under consideration.

Rather than establish a structured evaluation criteria, the team favored the development of a more flexible evaluation framework that would enable the assessment of broad potential for each of the technologies under consideration.

The Objectives were developed based on consideration of the long term objectives of the ERCB and CEAA (2004), of which the ERCB Directive 074 forms a component. The Objectives also consider the Alberta Environment (AENV) Draft Tailings Management Framework (May 25, 2011). These objectives were aligned with respect to a broad range of stakeholders considered in the workshops and included:

- mining companies and investors;
- First Nation communities;
- non-government organizations;
- local communities;
- consumers;
- media;
- research and development organizations; and
- the various in Federal, Provincial and Municipal government departments:
  - AENV;
  - ERCB;
  - DFO;

- Forestry;
- Alberta Infrastructure;
- Sustainable Development; and
- Municipality of Wood Buffalo.

For each Objective, a series of Sub-objectives were developed. This included consideration of the key attributes necessary to achieve the stated Objective and the understanding that there may be more than one way to achieve a particular Objective. The development of the Objective and Sub-objectives were defined so as not to exclude any particular tailings technology from consideration within the evaluation.

The life cycle categories for each technology was considered in the development of the Objective and Sub-objectives. These were based on the work completed by the Component 1 study team and were developed to ensure broad agreement with the mining and reclamation life cycle. The key life cycle categories included:

- mining;
- extraction and bitumen recovery;
- facility preparation;
- tailings processing;
- deposition and capping;
- water treatment; and
- reclamation.

2.3.2 Objectives and Sub-objectives

The development of the Objectives and Sub-objectives was an iterative process and benefitted from input from the broad CTMC team and the client representatives. The final version of the Objectives and Sub-objectives (Version 2.3) is presented below. This is based on the results of input from Client Workshop #1 held at the Golder Associates office on August 8, 2011.

a. To minimize production and long-term storage of fluid fine tailings.

   i. Produce mine feed that has lower fines content and less variability in materials sent to the plant.

   ii. Liberate less fine tailings in the extraction process.

   iii. Maximize dewatering of tailings during processing and during deposition.

   iv. Optimize the capture of fines within other waste materials.

   v. Maximize consolidation of deposited tailings.

vi. Reduce legacy tailings volumes.

vii. Ability to monitor/assess performance.

b. To manage tailings in a manner that minimizes the impacts of process affected water on the environment.

i. Minimize fresh water import.

ii. Maximize use of recycle water for internal and external users.

iii. Ensure water released to the environment meets applicable environmental standards.

iv. Maximize opportunities to utilize water in other industrial applications.

c. To facilitate progressive reclamation and achieve a trafficable surface as soon as possible following the cessation of deposition.

i. Rapid dewatering of deposited tailings to obtain a trafficable surface.

ii. Early removal of surface water.

iii. Use of available capping methodology (including trafficability of applicable equipment).

iv. Early development of sufficient strength to allow reclamation.

v. Minimal interference with operations.

vi. Ability to manage process affected materials within the tailings (e.g. salts).

vii. Compliance with Directive 074 criteria.

a) (Could include sub-bullets of Directive 074 criteria).

d. To reduce ongoing operations liability and long-term closure liability.

For “dry” reclamation:

i. Minimize settlement so as not to disrupt closure surface drainage.

ii. Maintain geotechnically stable landforms.

iii. Minimize time to reach certification.

iv. Maximize ability to manage process affected materials below the reclaimed surface (e.g. salts).

v. Minimize greenhouse gas emissions.

vi. Minimize air quality impacts for both gases and dust.

vii. Ability to monitor/assess performance.

For aquatic reclamation:

i. Minimize time to reach certification.

ii. Maintain hydrologically stable water/lake level.

iii. Maintain geotechnically stable containment slopes; both submerged slopes and above lake level slopes.

iv. Maximize ability to manage tailings within the associated storage areas.

v. Ability to monitor/assess performance.

e. To minimize footprint of permanent tailings facilities.

i. Enable in-pit disposal area as early as possible in the lifecycle.

ii. Minimize footprint of external tailings facilities.

f. To minimize cost of construction, operations and reclamation without compromising safety.

i. Minimize “front end” capital costs.

ii. Minimize operating costs (e.g. chemicals, materials, equipment, energy, people, etc.).

iii. Minimize reclamation and closure costs.

g. To use robust technologies.

i. Variability of tailings feed.

ii. Changes in regulations.

iii. Different fine tailings products.

iv. Seasonal operation.

v. Variability of mine feed.

vi. Variability of water chemistry.

vii. Technology changes within the mine life-cycle.

viii. Ability to monitor/assess performance.

ix. Reliability of component supply.

x. Reliability of system.

xi. Level of process control.

xii. Need for continuous operation.

h. Potential to reach commercial implementation.

i. Scalability to commercial operations.

ii. Cost and time required to bring technology to commercial readiness.

iii. No “black boxes” (i.e. the scientific basis of the technology is well understood).

2.4 Task 7 – Identify Constraints and Opportunities

A workshop was held March 9, 2012 to review the technologies identified and characterize the constraints and opportunities for the technology roadmap technology suites. The intent for the meeting was to screen for big picture opportunities and hurdles with respect to implementation of technology to tailings management. The objective was to list and characterize the key constraints and opportunities for development of the roadmap.

The following list provides a summary of the key opportunities and constraints identified during the workshop. It was recognized during discussions that most opportunities may be reframed as constraints by modifying the context of the description and vice versa. The following list reproduces the results of the workshop.

2.4.1 Opportunities Identified

- Performance standards should be developed that are appropriate for a suite of technologies. These standard should recognise the limitations of each technology suite for its application in the work cycle.
- Removal of boundaries between companies to jointly develop leases may improve efficiencies in tailings management.
- More open access to research and development information with operators, vendors and researcher and other interested parties.
- Realistic timelines for technology development. Pursue technologies that meet the regulatory timelines.
- Manage public perception of realistic timelines to adopt technology and close mining operations.

- Regulatory environment that allows a logical progression of technology development and adaption within the normal research and development cycle, and the mining operations under consideration.
- Look for opportunities to separate and manage different waste streams. Review opportunities for differential disposal.
- There will not be one solution to tailings management for a project dependant on site conditions and stage of development.
- Waste brokerage. A system to manage waste streams within a centralized system as a resource.
- Look at regional opportunities for treatment of waste products. This includes solids, fines and water.
- Improvements to depositional techniques. Look at how waste is discharged and improve measurement and development of the discharge.
- Review the chemistry of the oil sands tailings. Understand how the chemistry of the tailings impacts the treatment and management of the tailings.
- Common information database and resources for parties interested in oil sands opportunities. The resource should explain the basic requirements for a technology prior to bringing this to the industry.
- Develop methods to allow technologies to scale-up to oil sands scale of operation.
- Independent screening process for prospective technologies.
- Acceleration initiatives. Provide incentives to technology development by government and industry.
- Reduce the toxicity of the tailings.
- Remove bitumen in ponds which impact migratory birds.
- Benchmarking with other industries to identify technologies of merit.
- Alternate routes to trafficability than those envisaged to date. Review the full life cycle to reclaimed surfaces.
- The disposal (or use) of process-affected water in unconventional ways, such usage by SAGD operations or other industries to reduce energy and costs in treatment or disposal. Consider the tailings process water a resource rather than a waste product.
- Alternate extraction methods that might provide beneficial tailings treatment solutions.
- Identification of options that may be both technically and operationally complementary to each other, whereby a combination of those options could lead to greater efficiency and effectiveness than otherwise achieved in isolation.

- Provide the public with assurance that the liabilities associated with reclamation will be managed. Develop a mechanism that provides stewardship to the process and sets the direction and requirements for reclamation.
- Introduce a process for development of new technologies with the regulator which includes stewardship to goals and timelines and defined measurement of outcomes and future liabilities. The process allows development of technologies.
- Review opportunity for perpetual (or longer term) care on closure landscape, which may allow alternate tailings technologies that are less risk and lower cost.

2.4.2 Constraints Identified

- Scale of pilot tests required is a constraint to implementation of the technology. There presently exist a considerable time, cost and risk of early adoption to projects.
- Arbitrary goals for tailings and strength gain that are not tied to closure requirements. The close integration of the mining, extraction and tailings management operations means that prescriptive regulations may have significant unintended long term consequences to operations.
- Not recognizing or understanding the timeline required to develop technologies.
- Space constraints to development and management of tailings. This is driven by the ubiquitous presence of resources within the mineable area.
- Inability to release water. Prior commitments from the industry, and lack of regulatory standards for release.
- The industries effectiveness in water reduction has become an issue. The more effective industry is at dewatering tailings, the larger the problem we have with water quality, water management and the need to release water from sites.
- Hindrances in integration into existing mining/tailings operations and technologies.
- Time required for full research and development of particular solutions
- Unknown environmental impacts as a result of development of new technologies.
- Lack of public credibility of the industry. Poor industry image.
- Limited government technical resources and expertise.
- Skills shortage in the industry at the time of unprecedented expansion.
- Prescribed requirement for walk away, return to original land use reclamation.

2.4.3 Themes from Workshop

The following key themes and related opportunities/constraints were identified during the workshop and were recurring in most of the discussions:

- Regulatory framework: The regulations in which the oil sands operate have a significant impact on the implementation and development of technology for tailings management. For new technology to be applied the regulatory framework needs to be considerate of the potential for different technologies to achieve the desired end result.
- Information sharing: The workshop participants observed the significant progress that recent information sharing has achieved in technology assessment. Such initiatives has increased the speed of research, reduced the demand for research and industry specialists and reduced costs and risks for the various industry stakeholders.
- Cooperation between industry stakeholders and industry: The ongoing cooperation between stakeholder and industry is also considered a positive result for tailings management.
- Timelines for development and reclamation cycles: Observations that the understanding of reasonable time scales for reclamation of oil sands tailings ponds is not very well understood outside the industry. The development of information packages which provide realistic timeframes for reclamation of tailings would assist industry in portraying the investment and commitment to reclamation currently in place. Overall the industry would benefit from a more consistent approach to education of the scale and advancement in technology that has been achieved by industry.
- Scale: The scale of the tailings management within the oil sands is poorly understood by many sectors. It is a common theme that people unfamiliar with the industry do not fully appreciate the issues that scale has on the development and implementation of new technologies.
- Water management: The management of water is probably the primary challenge for tailings management. Ongoing review of water management within the oil sands industry is needed. This is not just in the reduction of future demands for water for operation, but in the management of water released from tailings from the successful implementation of these new technologies.

2.5 Review of Component 3 Indicators

The Component 2 team was requested to review the indicators developed by the Component 3 team as part of the development of screening criteria. Given the consensus that was achieved around the Objectives and Sub-objectives, the review was completed to ensure that the indicators developed by the Component 3 team reflect a consistent approach to review of the various technologies under consideration.

The review was completed as part of a matrix assessment in which the Indicators were mapped based on where they correspond to the Sub-objectives. In general, the review showed good correlation between the Indicators and the Sub-objectives that these criteria were based. The results of the review are presented in Appendix I.

3 CLOSING

This report is an instrument of service of Klohn Crippen Berger Ltd. and by extension the Consortium of Tailings Management Consultants (CTMC). The report has been prepared for the use of Alberta Innovates - Energy and Environment Solutions for the specific application to the "Tailings Deployment Roadmap and action plan for "end to end" solutions for oil sands tailings project". The material in this report reflects our best judgement in the light of the information provided at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made on it, are the sole responsibility of such third parties. Klohn Crippen Berger Ltd. and the CTMC accept no responsibility for damages, if any, suffered by any third party as a result of decisions or actions based on this report. In preparing this report we have endeavoured to comply with generally-accepted professional practice common to the industry, and the local area. No other warranty is made either express or implied.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Brett Stephens, P.Eng.
Principal, Senior Geotechnical Engineer

APEGA Permit to Practice P09196

APPENDIX I

Indicators versus Sub-objectives

OBJECTIVES AND SUB-OBJECTIVES

	Indicators / Technical Criteria	C6	1	2	3	4	5	6	7	8	C7	1	2	3	C8	1	2	3	C9	1	2	3	4	5	6	7	8	C10	1	2	3	4	5	6	7	8	C11	1	2	3	4	5	6	7	8	C12	1	2	3	4	5	6	7	8	C13	1	2	3	C14	1	2	3	4	5	6	7	8	C15	1	2	3	# of objectives that correlate to the indicator
1	Feed characteristics		×		×																																																																																							9
2	Fresh tailings		×	×	×				×			×	×														×														×				×	×			×					×										×																			13
3	MFT							×	×																		×			×	×							×			×							×	×					×	×																											11
4	Bitumen extraction		×	×								×	×					×							×																							×	×																																	10
5	Fluid fine tailings formation		×	×	×		×	×	×			×	×							×	×	×	×			×				×														×																																							15
6	Tailings Footprint		×	×	×	×	×	×	×									×		×	×		×			×				×				×										×																																					17
7	Design complexity																																																																																						15
8	Construction complexity									×								×						×						×	×												×																																									16
9	System flexibility																							×																																																														14
10	System Reliability																																																																																													9
11	Geotechnical product quality			×	×	×	×			×								×			×	×			×											×																																																					18
12	Process product quality			×	×		×	×		×						×	×	×		×			×	×	×	×			×	×	×	×			×			×						×																																											23
13	Consolidation			×		×	×			×								×					×				×	×	×						×		×						×																																											14
14	Water recovery		×	×	×	×	×	×	×			×	×					×			×	×					×			×												×																																												15
15	Water treatment: short-term		×	×	×	×			×			×	×	×		×	×	×			×										×				×		×	×			×		×																																										19
16	Water treatment: long-term															×	×	×			×										×				×		×	×			×		×																																												11
17	Technical uncertainty																																																																																													10
	Environmental Criteria																																																																																													
1	Geotechnical and seismic hazards/risk			×	×		×	×	×									×			×	×					×	×	×	×	×				×			×	×			×																																																16
2	Erosion and sedimentation									×								×					×				×	×	×			×	×			×	×	×																																																	12
3	Fresh water usage			×	×	×	×					×	×				×			×	×					×																																																															10
4	Process recovery water quality			×		×				×			×	×						×	×					×																																																														9
5	Surface water quality								×	×						×	×	×			×					×				×						×		×						×																																												12
6	Groundwater quality				×		×	×	×	×						×	×	×							×				×	×				×		×			×		×																																														15
7	Air emissions									×																						×	×	×					×	×																																													6
8	Greenhouse gas emissions									×																						×	×	×					×	×																																													6
9	Release of COC (Contaminant of Concern) into the Environment									×								×																		×		×						×																																											10
10	Ecosystems: short term								×							×	×	×			×					×						×																																																									8
11	Ecosystems: long term					×	×	×								×	×	×								×			×		×	×							×																																																12
12	Weather conditions				×					×								×					×												×																																																						9
	Social Criteria																																																																																													
1	Health and Safety									×																		