The Mining Association of Canada | L'association minière du Canada

Progressive Approaches to Mine Tailings Management in Canada

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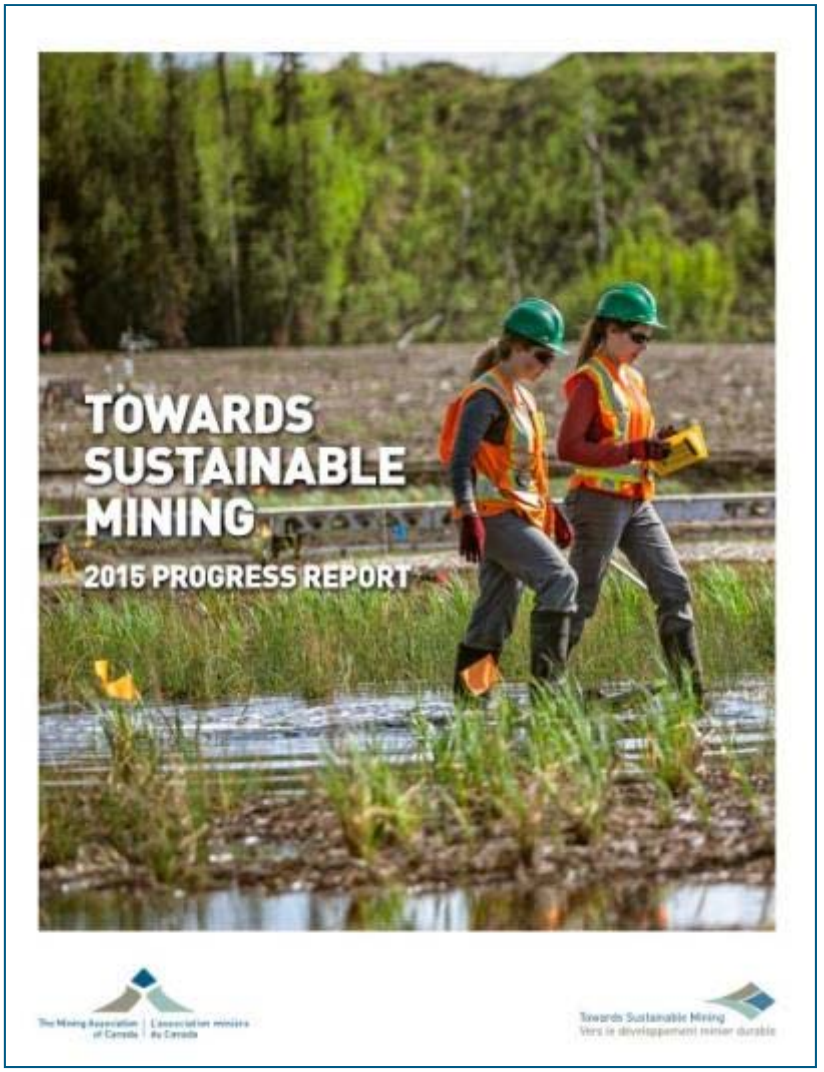
ABOUT THE MINING ASSOCIATION OF CANADA (MAC)

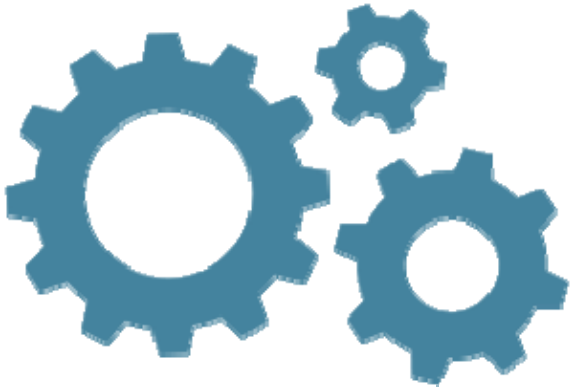
- Established in 1935, MAC
  - promotes industry nationally and internationally
  - works with governments on policies affecting the sector
  - educates the public on mining
- Members account for most of Canada's production of metals and major industrial minerals
  - includes metals, diamonds, oil sands and metallurgical coal
- Associate members comprise a wide range of services and equipment supplied to the mining industry

TOWARDS SUSTAINABLE MINING (TSM)

- TSM established in 2004
- Improves environmental and social performance in critical areas beyond regulations:
  - environmental footprint
  - energy efficiency
  - community and people
- Program strengths:
  - Performance measured at facility-level, and results externally verified
  - Monitored by external Community of Interest (COI) Advisory Panel
  - Encourages continuous improvement



SCOPE OF TSM

Environmental Stewardship	Communities & People	Energy Efficiency
		
Tailings Management Biodiversity Conservation Management	Aboriginal & Community Outreach Safety & Heath Management Crisis Management	Energy Use & Greenhouse Gas Emissions Management

Community of Interest Advisory Panel

APPLICATION OF TSM

- Participation is TSM is mandatory for all MAC members for their operations in Canada
- Some MAC members also reporting on TSM performance at their operations in other countries: Finland, Turkey, Surinam, Burkina Faso
- Being implemented but not yet reporting at some mines in: Australia, Greece, Peru, USA
- Growing interest in TSM around the world
  - Adopted in Finland
  - In process of being adopted in Botswana
  - Being seriously considered in several other countries around the world, including in South America, Asia and Europe

EFFECTIVE TAILINGS MANAGEMENT: AN INDUSTRY IMPERATIVE

- Serious tailings dams failures over the last several decades have led to:
  - loss of life
  - severe environmental impacts
  - significant financial costs to mining companies, governments, and society as a whole
  - impact on the mining industry's reputation and social licence to operate
- These incidents underscore that effective tailings management is absolutely imperative
- Tailings are a business risk
- Increasing recognition that tailings management is a core business function for mining
  - tailings failures can break a company, financially

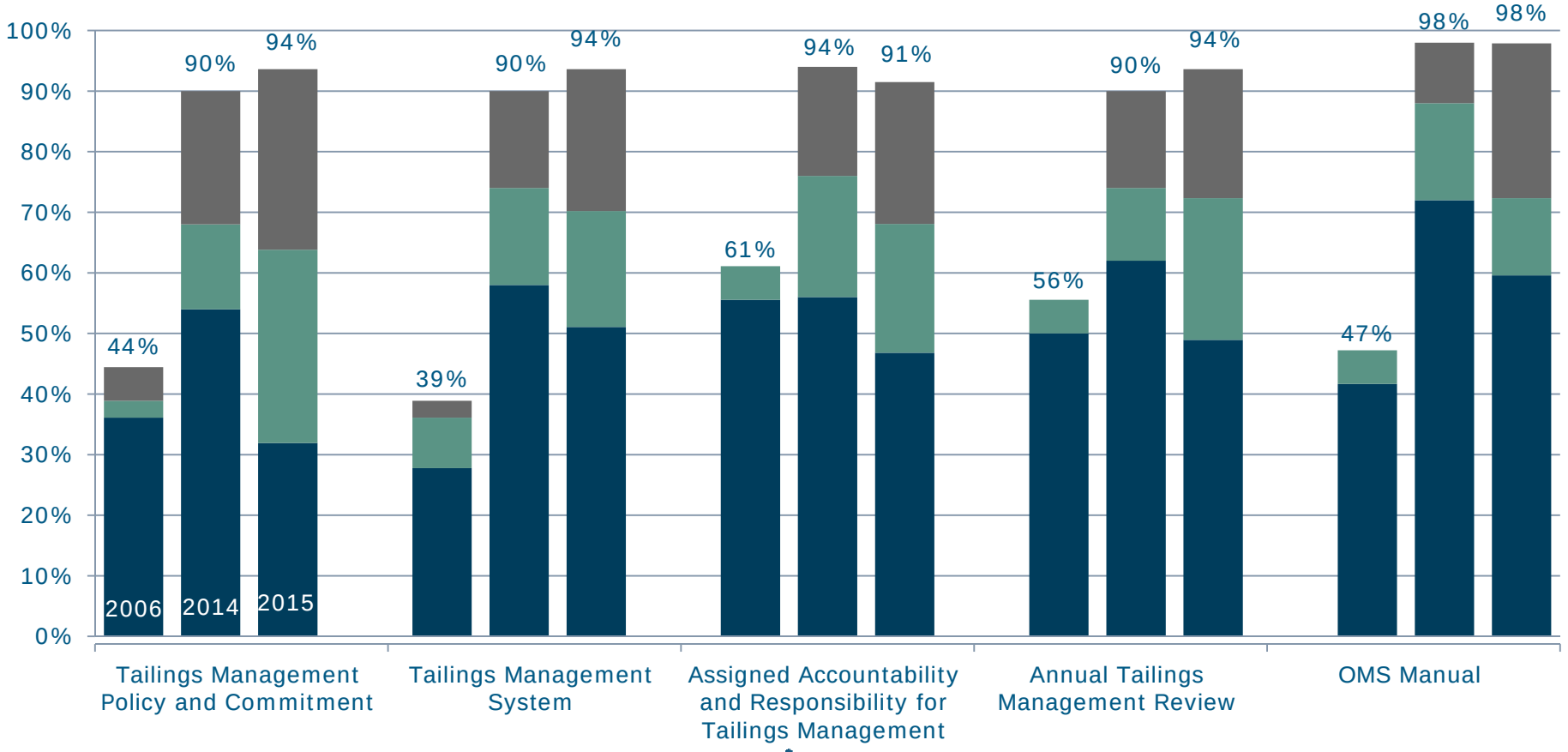
TAILINGS MANAGEMENT PROTOCOL

- Contains five performance indicators designed to confirm whether a facility has implemented a system for responsible tailings management
- Refers to the three Guides that provide more detailed requirements
- Facilities must conduct annual reviews of their management system and report results to the accountable executive officer
- TSM uses a 5 level rating scheme: C, B, A, AA and AAA

Tailings Management Indicators
Tailings management policy and commitment
Tailings management system
Assigned accountability and responsibility for tailings management
Annual tailings management review
Operation, maintenance and surveillance (OMS) manual

PERFORMANCE AGAINST PROTOCOL INDICATORS

Tailings Management Assessments
Percent of Facilities at Level A or Higher
2006, 2014 & 2015



TAILINGS MANAGEMENT COMPONENT OF TSM

Tailings Management Protocol supported by three guides:

- *A Guide to the Management of Tailings Facilities* (the Tailings Guide)
- *Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities* (the OMS Guide)
- *A Guide to the Audit and Assessment of Tailings Facility Management* (the Audit Guide)

MAC REVIEWING TAILINGS MANAGEMENT COMPONENT OF TSM

- In August 2014, a major tailings dam failure occurred at the Mt. Polley Mine in British Columbia
- Soon after, the MAC Board of Directors decided to conduct an independent review of tailings management component of TSM
- In early 2015, a panel investigating Mt. Polley released their final report, which recommended that:
  - "Corporations proposing to operate a tailings storage facility (TSF) should be required to be a member of the Mining Association of Canada (MAC) or be obliged to commit to an equivalent program for tailings management, including the audit function"
- MAC decided to continue with the independent, external review, and also launched a parallel internal review

EXPECTED OUTCOMES OF REVIEW

- Internal and external reviews complete, and work of revising the Protocol and the Tailings Guide is underway
- Revised Protocol raising the bar on what is required to obtain a level A, AA or AAA
- Revised Tailings Guide expected to:
  - Retain strong focus on management systems
  - Incorporate a risk-based approach as integral element of the Tailings Guide, with tailings facilities managed commensurate with risks that they pose
  - Place greater emphasis on best available technologies (BAT) and best available practices (BAP) for tailings management
  - Require rigorous, transparent process to select tailings management technologies and tailings facility location

CHALLENGES FOR TAILINGS MANAGEMENT IN CANADA

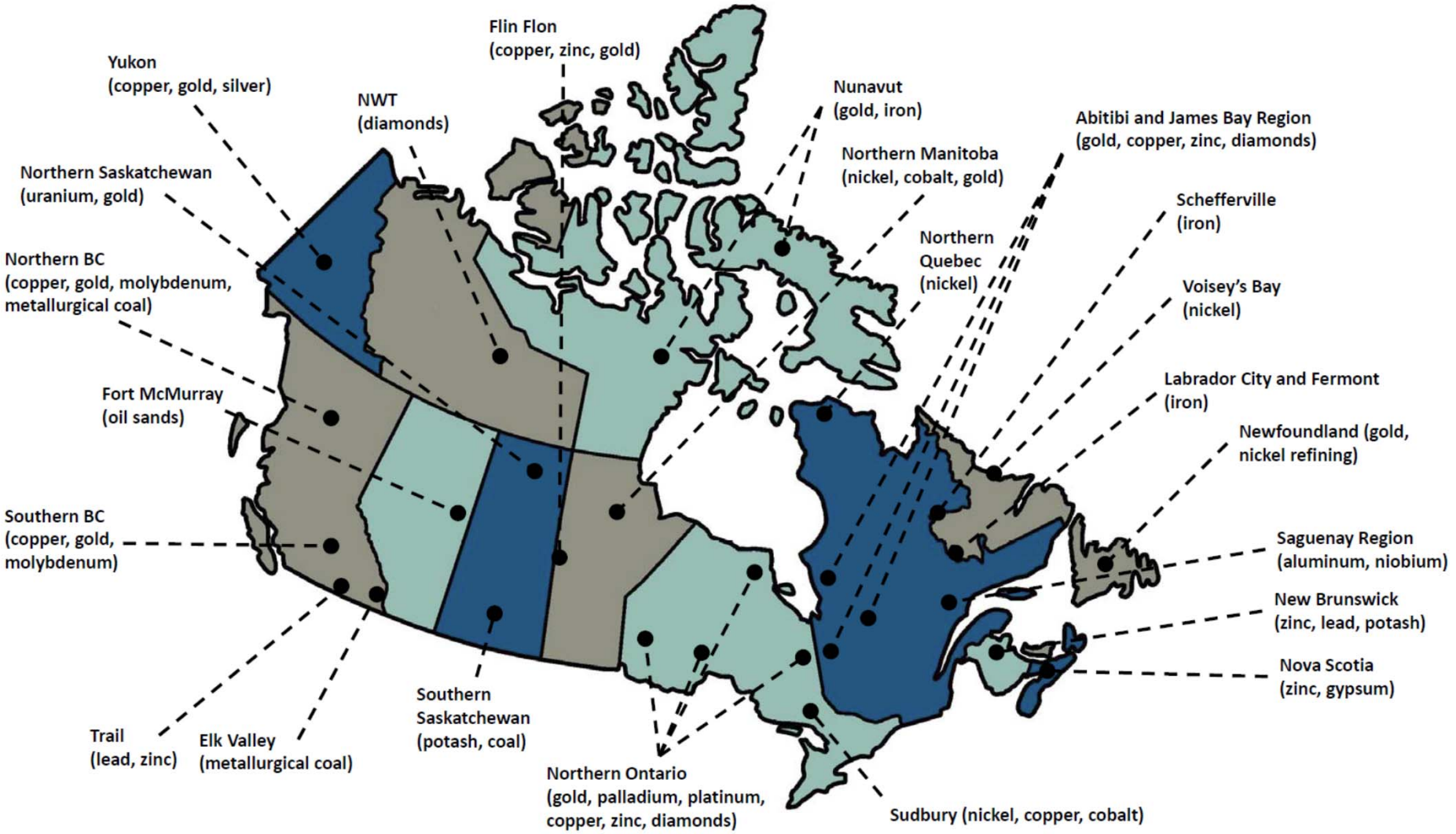
Complex regulatory environment:

- Natural resources are a provincial responsibility, but federal government also plays a role
- Thus, there are 14 different sets of rules across the country

Geographic diversity:

- Mines are operating across Canada:
  - alpine regions with very high precipitation, or with very low precipitation
  - Arctic conditions, with permafrost and very low precipitation
  - boreal forest conditions, with wide climate ranges from winter to summer, and a very high density of water bodies
- Some operating close to populated areas, others in very remote areas accessible only by air and winter ice roads

CHALLENGES FOR TAILINGS MANAGEMENT IN CANADA



CHALLENGES FOR TAILINGS MANAGEMENT IN CANADA

Wide range of mine types:

- Metal mines in Canada range from small underground gold mines to very large open pit base metal and iron ore mines
  - volumes and characteristics of tailings produced highly variable
- Other types of mines that also product tailings, including oils sands mines and metallurgical coal mines
- Some mines have been operating for many decades, others are brand new

With such variability across the Canadian mining industry, there is no on-site fits all solution for tailings management

CANADIAN EXAMPLES OF PROGRESSIVE TAILINGS MANAGEMENT: ÉLÉONORE MINE

- Underground gold mine in Quebec owned and operated by Goldcorp
- Entered production in 2015, processing about 5000 tonnes of ore per day
- In-plant destruction of cyanide
- Separate flotation circuit in the mill to remove sulphides from tailings
- High sulphur tailings used as paste backfill underground
- Desulphurized tailings dewatered to about 85% solids and transported to tailings facility by truck
- Tailings facility is fully lined
- Tailings will be deposited sequentially in five adjacent cells, allowing progressive reclamation through mine life
- Run-off water collected in lined pond and re-used in the mill or treated and released

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CANADIAN EXAMPLES OF PROGRESSIVE TAILINGS MANAGEMENT: ÉLÉONORE MINE

CANADIAN EXAMPLES OF PROGRESSIVE TAILINGS MANAGEMENT: GOLDEX MINE

- Underground gold mine in Quebec owned and operated by Agnico Eagle Mines
- Entered production in 2009, processing about 7000 tonnes of ore per day
- Mine produces very clean tailings, with no sulphides, in-plant destruction of cyanide, and high neutralizing potential
- Mine is in a region with a long history of mining, with many legacy sites in the area
- About 25 km from Goldex is a legacy site, the Manitou Mine, with acid generating tailings
- Province of Quebec is responsible for Manitou
- Manitou tailings have been a source of water pollution for many years, and presented a significant reclamation challenge

CANADIAN EXAMPLES OF PROGRESSIVE TAILINGS MANAGEMENT: GOLDEX MINE

- Quebec and Agnico Eagle have an agreement in place
  - Goldex tailings are being placed on top of the acid generating Manitou tailings to provide a cover layer
  - Agnico Eagle contributing financially to cost of rehabilitation at Manitou, province paying the balance
- As cover thickness increases, the water table will rise, saturating the acid generating tailings
- High neutralizing potential of Goldex tailings will help to neutralize the acidic Manitou tailings
- Water treatment in place, and Quebec will retain legal liability for the site

https://www.mern.gouv.qc.ca/english/mines/quebec-mines/2007-06/manitou.asp

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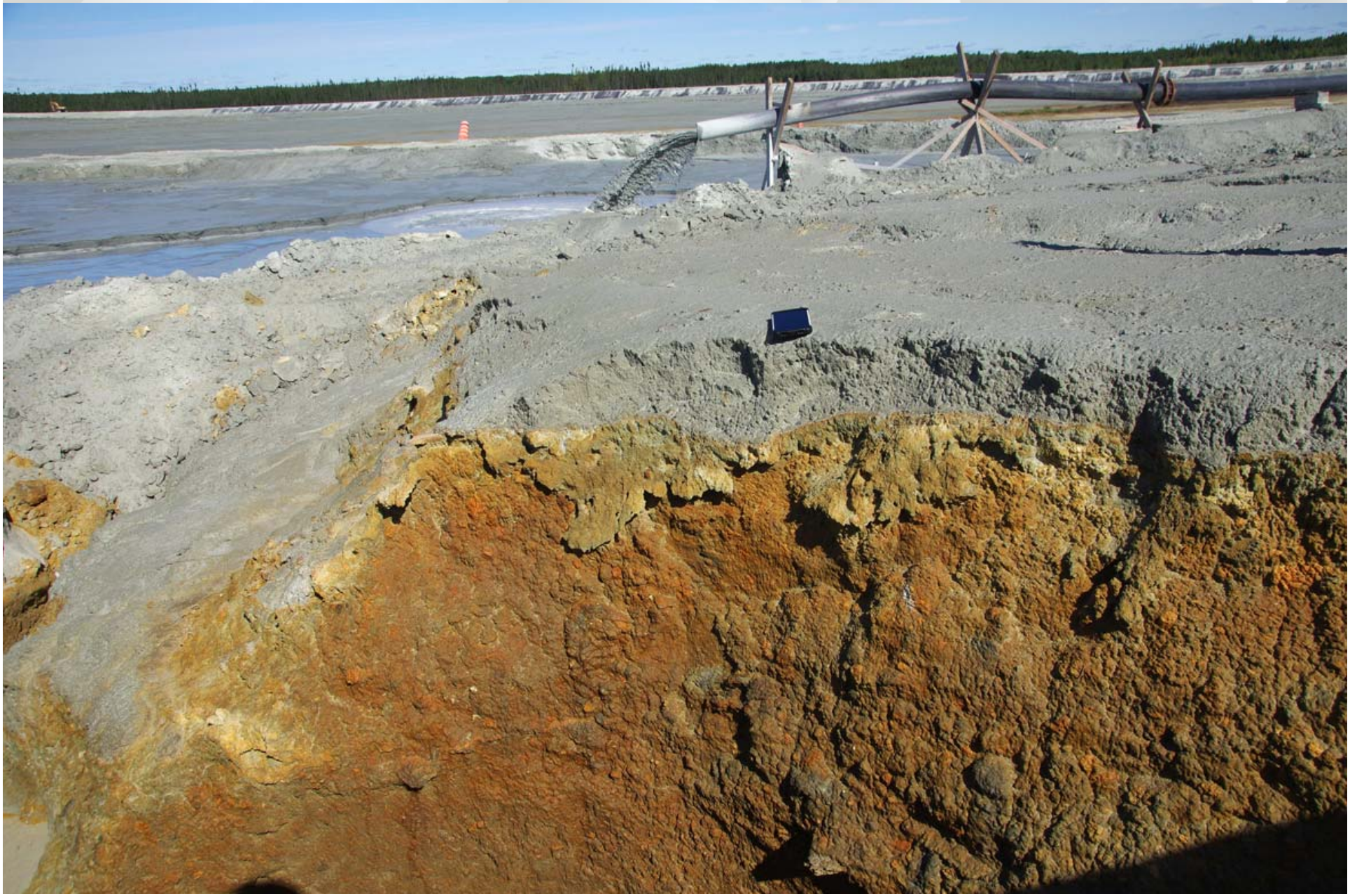

THANK YOU!

For more information on TSM:

http://mining.ca/towards-sustainable-mining

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