



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)

**THE WINDS OF CHANGE.**

Nickel, steel-making coal, copper and zinc are all critical to the efficiency of the turbines and towers of today's wind farms. Canada is one of the world's top mining countries, and our minerals and metals are found in products of all kinds.

MINING.CA

**CANADIAN MINING**  
Part of just about everything.

A message from the Mining Association of Canada.

- ◆ 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

- ◆ Geologist by training, first exposure to the mining industry was working in exploration
- ◆ Did graduate work looking at un-reclaimed tailings from the early 20th century
- ◆ Worked for 22 years with Environment Canada, the national environmental regulator in Canada
  - ◆ Mining effluent regulations and environmental monitoring program design
  - ◆ Best practices guidance
  - ◆ Review of environmental assessments
- ◆ Joined MAC two years ago
  - ◆ Leading work revising MAC's Guide to the Management of Tailings Facilities
  - ◆ Leading on science and innovation file

- ◆ TSM established in 2004
- ◆ Industry-led, voluntary program to improve 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 continual improvement



**Environmental Stewardship**

**Communities & People**

**Energy Efficiency**



***Tailings Management***

Biodiversity Conservation  
Management



Aboriginal & Community  
Outreach

Safety & Health Management

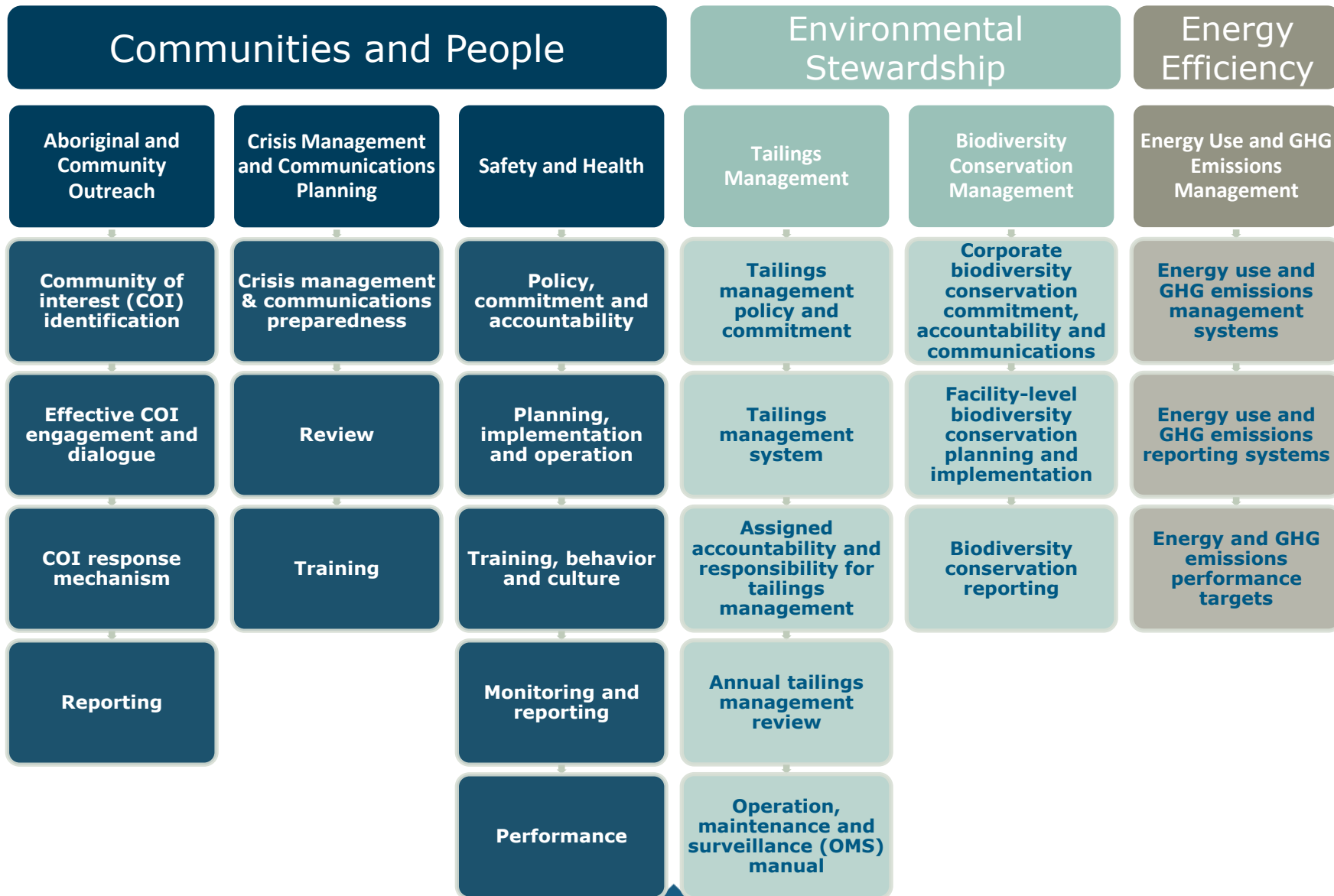
Crisis Management



Energy Use & Greenhouse Gas  
Emissions Management

**Community of Interest Advisory Panel**

# TSM PROTOCOLS AND INDICATORS



- ◆ Participation in *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, Argentina and Botswana
  - ◆ Being seriously considered in several other countries around the world, including in South America, Asia and Europe



- ◆ Each implementing association is required to have something in place to meet each of the following seven components:
  - ◆ Guiding Principles
  - ◆ Performance Indicators
  - ◆ Facility Level Reporting
  - ◆ Independent Verification
  - ◆ Public Reporting of Facility Level Reporting
  - ◆ Condition of Membership
  - ◆ Community of Interest Advisory Body
- ◆ It is left up to the association, in conjunction with their Community of Interest Advisory Body, to decide how best to implement each item



- ◆ 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 also a business risk
  - ◆ increasing recognition that tailings management is a core business function for mining
  - ◆ tailings failures can break a company, financially



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**Mount Polley, Canada, 2014**



**Samarco, Brazil, 2015**

- ◆ MAC established its Tailings Working Group in 1996, following a number of tailings dam failures internationally
- ◆ First edition of MAC's *Guide to the Management of Tailings Facilities* was released in 1998
- ◆ First edition of the Tailings Guide incorporated a management systems approach for tailings management, and:
  - ◆ provided information on safe and environmentally responsible management of tailings facilities
  - ◆ helped companies develop tailings management systems that included environmental and safety criteria
  - ◆ improved consistency of application of sound engineering and management principles to tailings facilities



- ◆ In 2003, MAC introduced a companion document to the Tailings Guide: *Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities* (the OMS Guide)
  - ◆ Intent of OMS Guide is to help in the implementation of tailings management systems at the operational level
- ◆ With the introduction of *TSM* in 2004, MAC developed the *Tailings Management Protocol*
- ◆ Protocol seeks to ensure that owners of tailings facilities have:
  - ◆ a formal policy in place
  - ◆ developed and implemented a tailings management system
  - ◆ assigned accountability to the CEO or COO of the company
  - ◆ developed operation, maintenance and surveillance manuals for all tailings facilities

- ◆ Contains five performance indicators designed to confirm whether an owner of a tailings facility has implemented a system for responsible tailings management
- ◆ Refers to the Guides that provide more detailed requirements
- ◆ Owners must conduct annual reviews of their management system and report results to the accountable executive officer

## 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

AAA

- Excellence and Leadership

AA

- Integration into management decisions and business functions

A

- Systems/processes are developed and implemented

B

- Procedures exist but are not fully consistent or documented; systems/processes planned and being developed

C

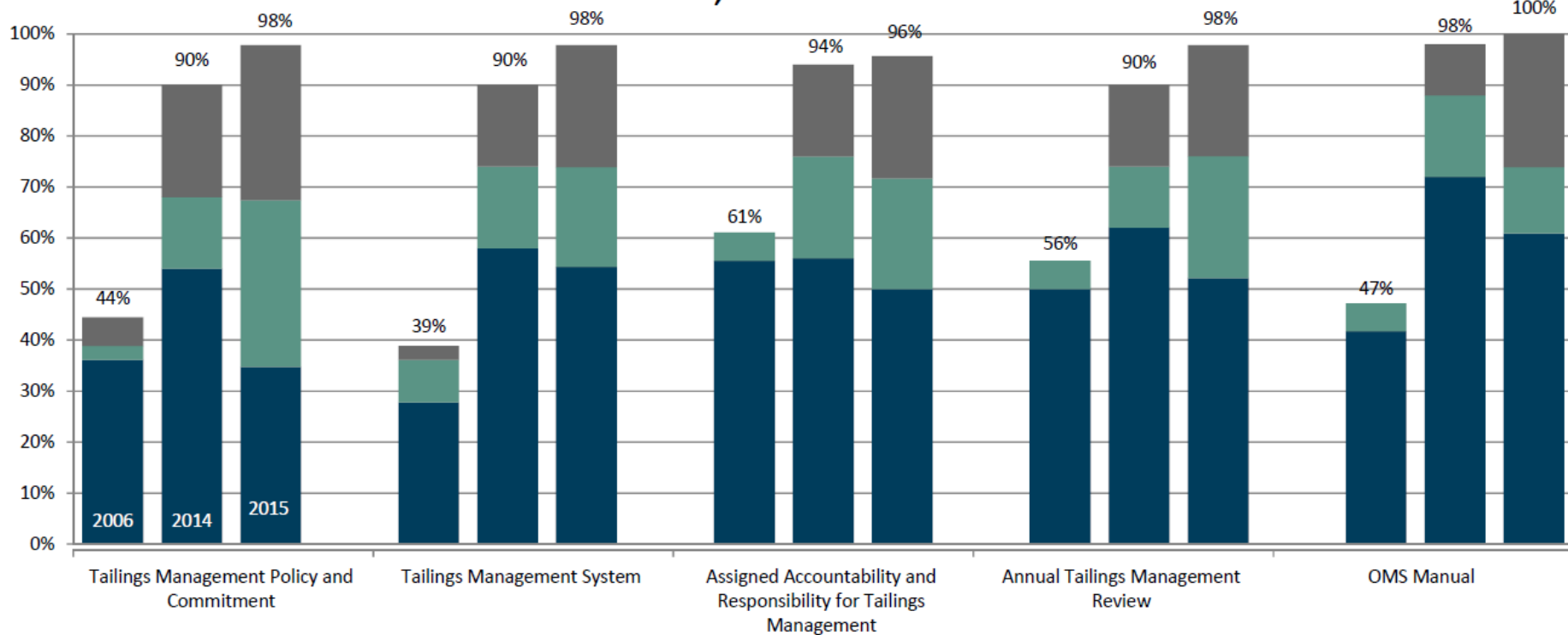
- No systems in place; activities tend to be reactive; procedures may exist but they are not integrated into policies and management systems

Level A

Level AA

Level AAA

## Percentage of Facilities at a Level A or Higher 2006, 2014 and 2015



- ◆ Management tool to help mining companies manage tailings facilities safely and responsibly
- ◆ Meant to be adapted to specific requirements and conditions at individual operations and sites
- ◆ Not a technical manual
- ◆ Not intended to replace professional expertise or regulatory requirements



- ◆ Key component of the Tailings Guide is the tailings management framework, which:
  - ◆ provides basis for development and implementation of site-specific tailings management systems
  - ◆ provides foundation for managing tailings in a safe and environmentally responsible manner
  - ◆ applicable through the full life cycle of a tailings facility from site selection and design, through construction and operation, to eventual decommissioning and closure

# TAILINGS GUIDE – TAILINGS MANAGEMENT FRAMEWORK

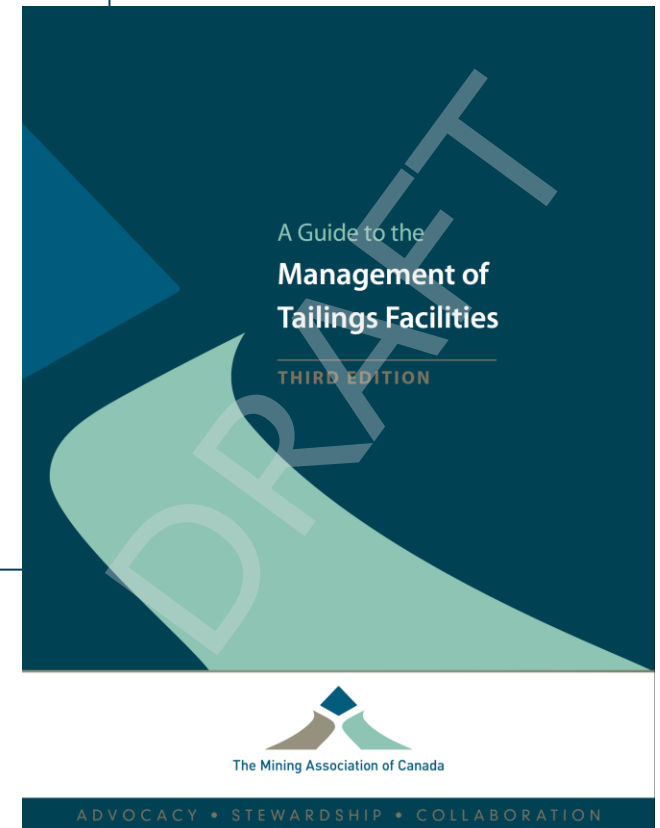
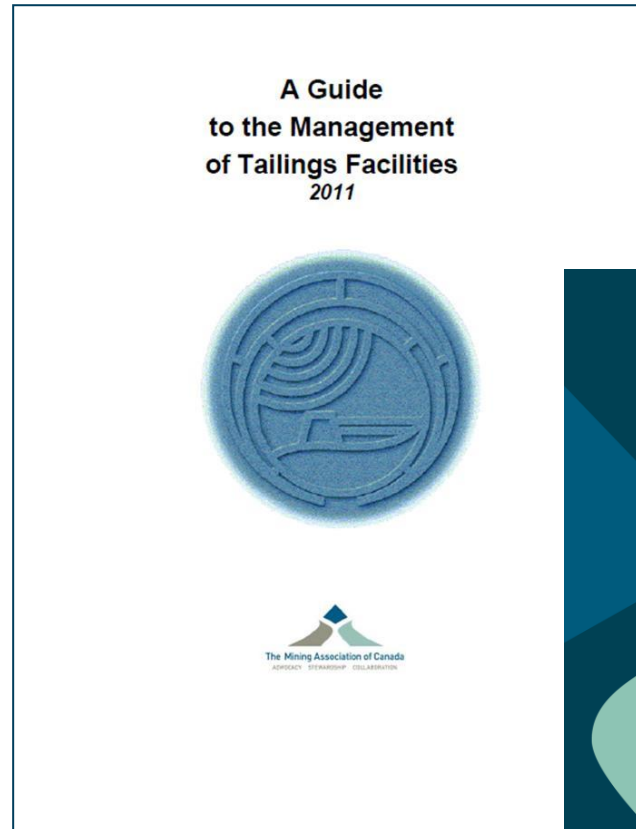


- ◆ In August 2014, a major tailings dam failure occurred at the Mt. Polley Mine in British Columbia
- ◆ Soon after, the MAC Board of Directors decided to conduct an independent review of tailings management component of *TSM*
- ◆ In early 2015, a panel investigating Mt. Polley released their final report, 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

- ◆ Internal and external reviews complete, and work of revising the Protocol and the Tailings Guide is almost complete
- ◆ Revised Protocol raising the bar on what is required to obtain a level A, AA or AAA
- ◆ Proposed revisions to Tailings Guide:
  - ◆ Retain strong focus on management systems, while strengthening technical components
  - ◆ Integrate a risk-based approach into the tailings management framework; consideration for both physical and chemical risks
  - ◆ Emphasize importance of selection and implementation of site-specific best available technologies (BAT) and best available/applicable practices (BAP)

- ◆ Proposed revisions, continued:
  - ◆ Emphasis on designing and operating for closure
  - ◆ Stress need for independent review and provide guidance on what that looks like
  - ◆ Strengthen key management components, such as:
    - ◆ change management
    - ◆ critical controls for risk management
    - ◆ performance evaluation

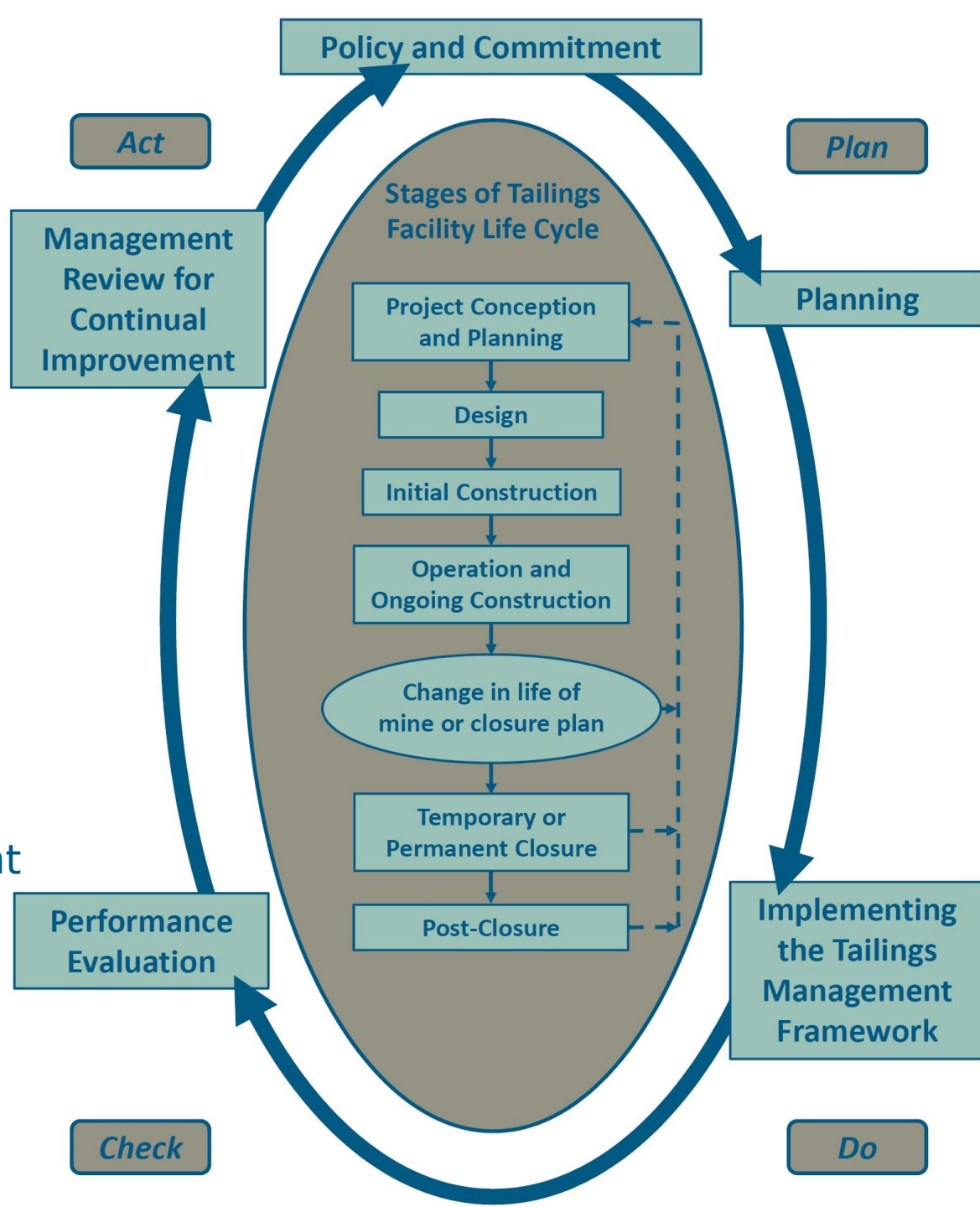
# Overview of Proposed Revisions



- ◆ Revised Tailings Guide strengthens a lot of concepts in the current Guide, and introduces others:
  - ◆ **Critical Controls:** identification, implementation and performance monitoring that defines actions designed to manage high-consequence risks relating to a tailings facility
  - ◆ **Engineer of Record:** provides technical oversight, including:
    - ◆ confirming that the tailings facility has been designed and constructed, and is performing in accordance with the design intent, applicable guidelines, standards and regulatory requirements
    - ◆ confirming that operating practices are consistent with that design intent
  - ◆ **Independent Review:** evaluation of all aspects of the design, construction, operation, maintenance of a tailings facility by competent, objective, third-party review

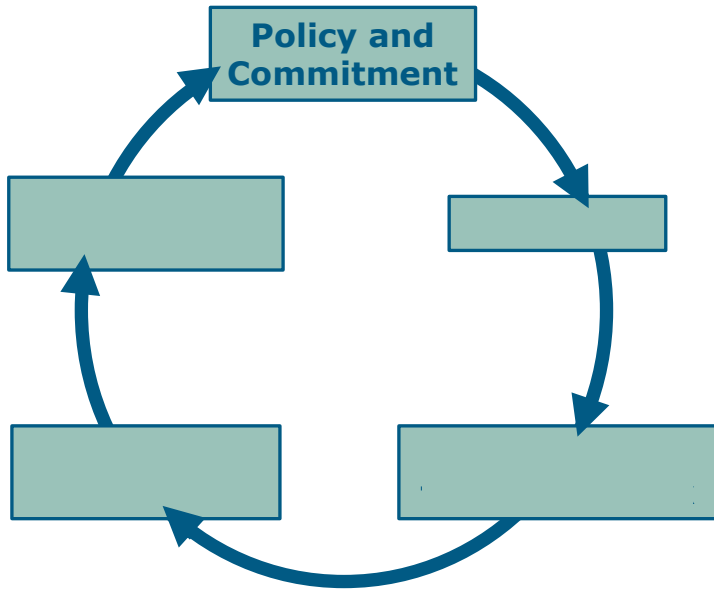
## TAILINGS MANAGEMENT FRAMEWORK – PROPOSED REVISIONS

- ◆ Inner oval makes clear link with application across the life cycle
- ◆ Life cycle portrayed as dynamic, rather than linear
- ◆ Better alignment with ISO 14001 and general principles of management systems: Plan – Do – Check – Act

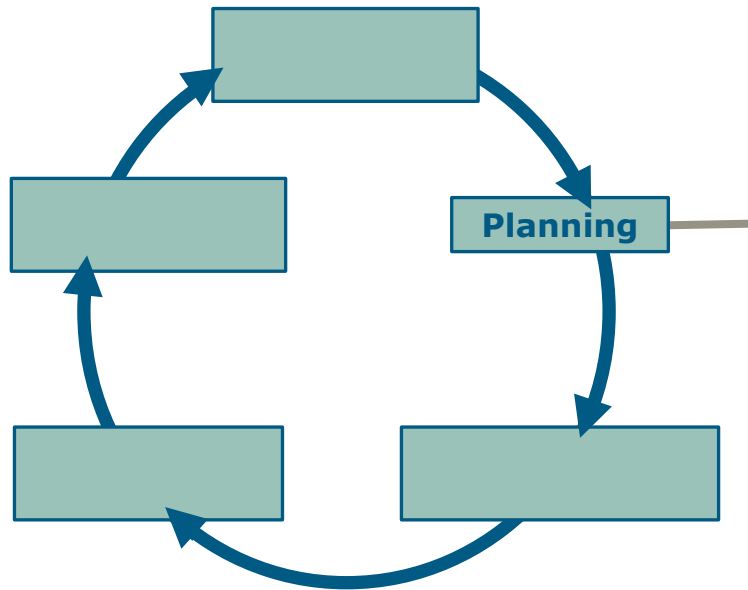




## TAILINGS MANAGEMENT FRAMEWORK: POLICY AND COMMITMENT



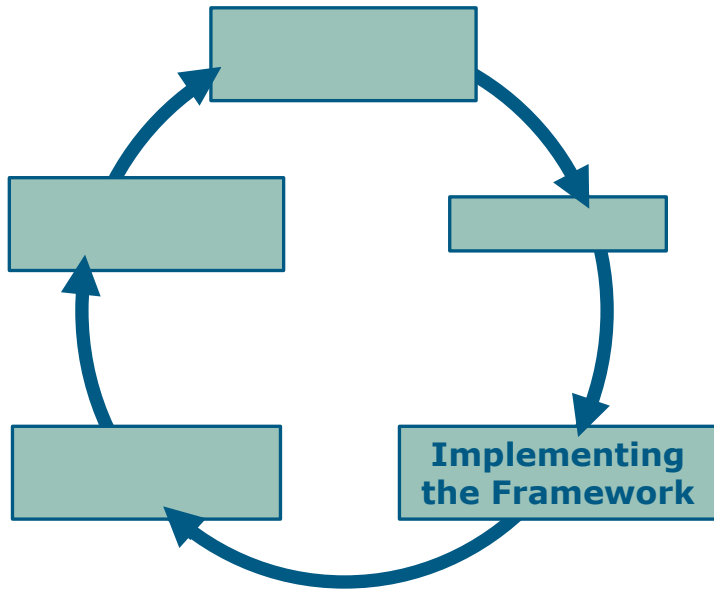
- ◆ Includes statement that Owners commit to manage tailings facilities commensurate with the risks they pose, with the objective of minimizing harm
- ◆ Minimizing harm encompasses both physical and chemical performance and risks associated with tailings facilities, including:
  - ◆ zero catastrophic failures of tailings facilities
  - ◆ no significant adverse effects on the environment or human health



- ◆ All aspects clarified and strengthened
- ◆ New sections on critical controls and quality management

- Risk management
- Performance objectives
- Accountability and responsibility
- Management process
  - ◆ Compliance management
  - ◆ Change management
  - ◆ Controls
    - ◆ Critical controls
    - ◆ Quality management
    - ◆ Operational controls (OMS manual)
- Resources and Scheduling
  - ◆ Financial control
  - ◆ Control of documented information
  - ◆ Training and competence
  - ◆ Communications

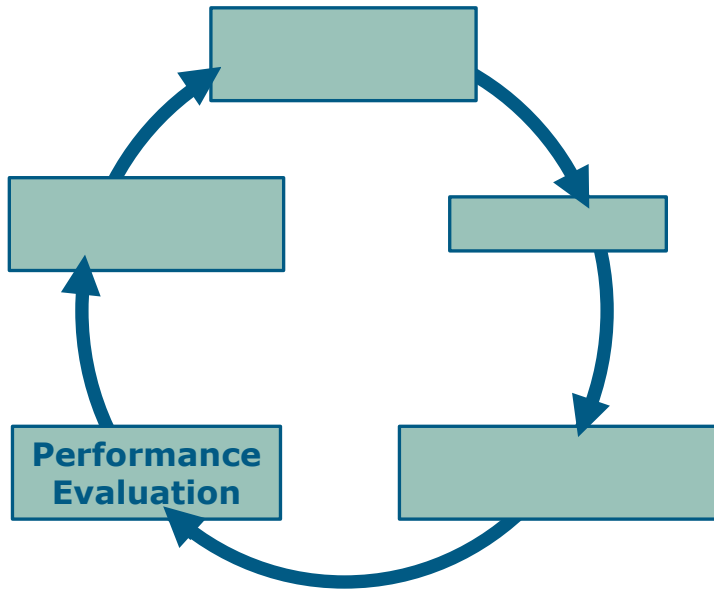
## TAILINGS MANAGEMENT FRAMEWORK: IMPLEMENTING THE FRAMEWORK



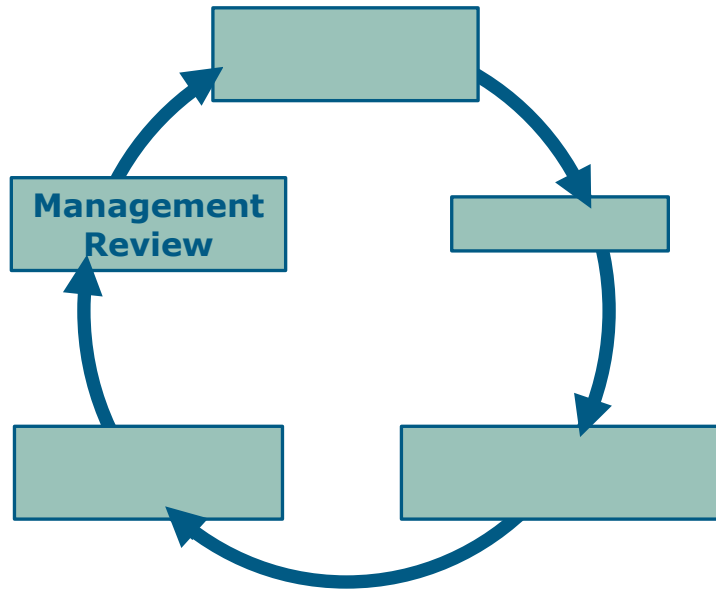
Focused on three key aspects:

- ◆ Implementation of the OMS manual
- ◆ Emergency preparedness and response plans
  - ◆ Details added
- ◆ Checklists
  - ◆ Use of checklists described as a tool for implementation
  - ◆ Checklists will be available in Excel to make them more useful

## **TAILINGS MANAGEMENT FRAMEWORK: PERFORMANCE EVALUATION**



- ◆ Clearer, more detailed and more specific
- ◆ Linked with surveillance results collected as per the OMS manual
- ◆ Internal and external reporting addressed
- ◆ Includes guidance on action plans
- ◆ Better alignment with ISO 14001



- ◆ Also clearer, more detailed and more specific
- ◆ Better alignment with ISO 14001
- ◆ Clear distinction between purpose and content of Management Review versus Performance Evaluation

## **Performance evaluation** is essential to:

- ◆ assess whether performance objectives are being met
- ◆ assess the effectiveness of risk management measures
- ◆ inform updates to the risk management plan for the tailings facility
- ◆ inform the Management Review for Continual Improvement

## **Management Reviews** should:

- ◆ evaluate the performance of the tailings management system to ensure its continuing suitability, adequacy and effectiveness
- ◆ evaluate the performance of the tailings facility
- ◆ identify opportunities and action plans for improvement

2017 update provides additional guidance in appendices:

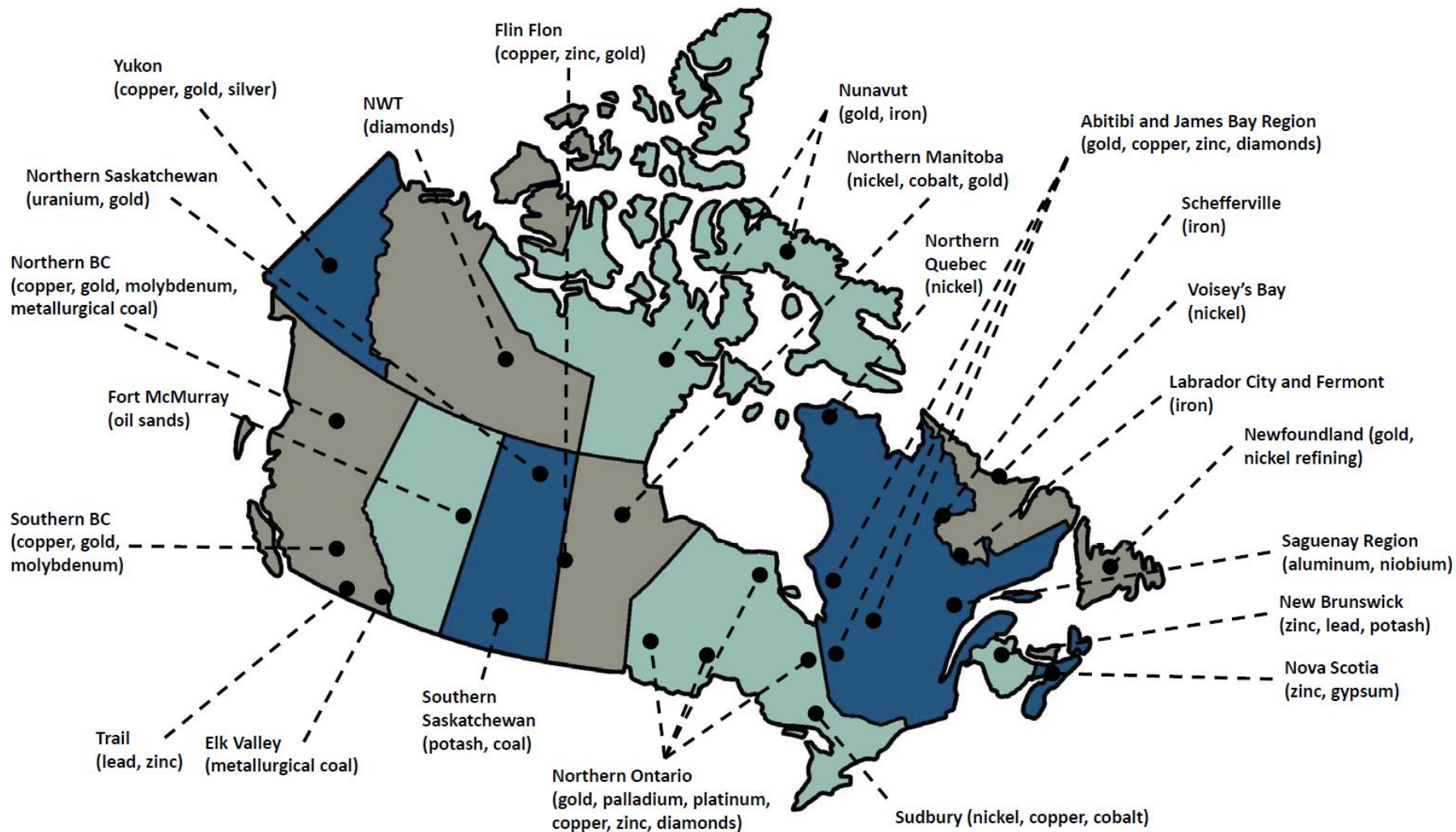
- ◆ Risk Management Framework and Approach
- ◆ Best Available Technology and Best Available/Applicable Practice
- ◆ Assessment of Alternatives
- ◆ Independent Review
- ◆ Considerations for Managing Across the Life Cycle of a Tailings Facility
- ◆ Technical Considerations
  - ◆ Tailings transportation and deposition plans
  - ◆ Water management plans
  - ◆ Closure plans

- ◆ Tailing Management Protocol almost finalized
- ◆ Tailings Guide currently going through final editing and layout
- ◆ Will be seeking final approval of MAC Board of Directors for both documents at their meeting in June

Goal: official rollout of the Third Edition of the Tailings Guide at Tailings and Mine Waste 2017 in November

- ◆ Work on revisions to the OMS Guide will begin in May

# 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

Wide range of mine types:

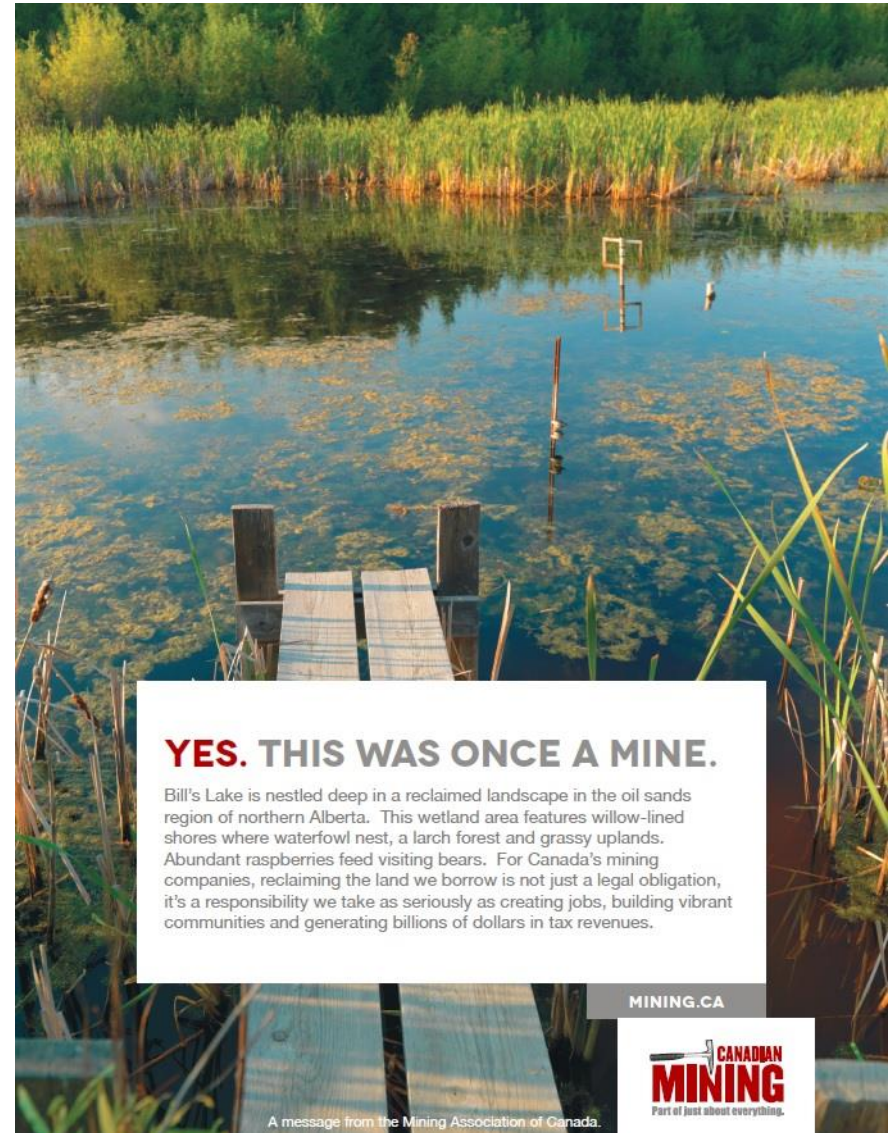
- ◆ Metal mines in Canada range from small underground gold mines to very large open pit base metal and iron ore mines
  - ◆ volumes and characteristics of tailings produced highly variable
- ◆ Other types of mines that also product tailings, including oils sands mines and metallurgical coal mines
- ◆ 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

For more information on TSM:

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

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**YES. THIS WAS ONCE A MINE.**

Bill's Lake is nestled deep in a reclaimed landscape in the oil sands region of northern Alberta. This wetland area features willow-lined shores where waterfowl nest, a larch forest and grassy uplands. Abundant raspberries feed visiting bears. For Canada's mining companies, reclaiming the land we borrow is not just a legal obligation, it's a responsibility we take as seriously as creating jobs, building vibrant communities and generating billions of dollars in tax revenues.

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A message from the Mining Association of Canada.