

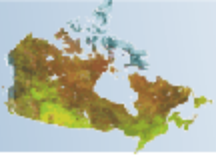
Strategy Themes and Outcomes - MEND and NOAMI

15th BC/MEND Workshop
December 3 and 4, 2008



Gilles Tremblay and Charlene Hogan
MEND, NOAMI and GARD Guide
Secretariats





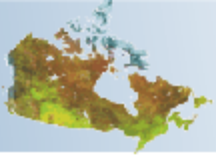
Presentation Highlights

MEND

- Background
- Technologies
- Work plan

NOAMI

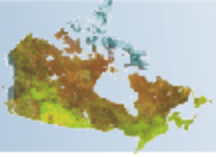




Mine Environment Neutral Drainage (MEND) Program

- The original MEND program (1989-1997) and its successors contributed enormously to understanding of acidic drainage and its prevention, and to increasing the transfer of knowledge to improve environmental management





MEND Program

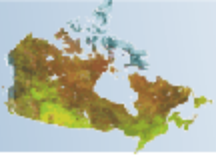


- 1989 – 2008
- Extensive national and international Network
- ~\$20M in 19 yrs
- Focused research work plan
- Technology transfer



Whistle Mine

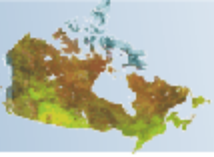




MEND Supported Technologies

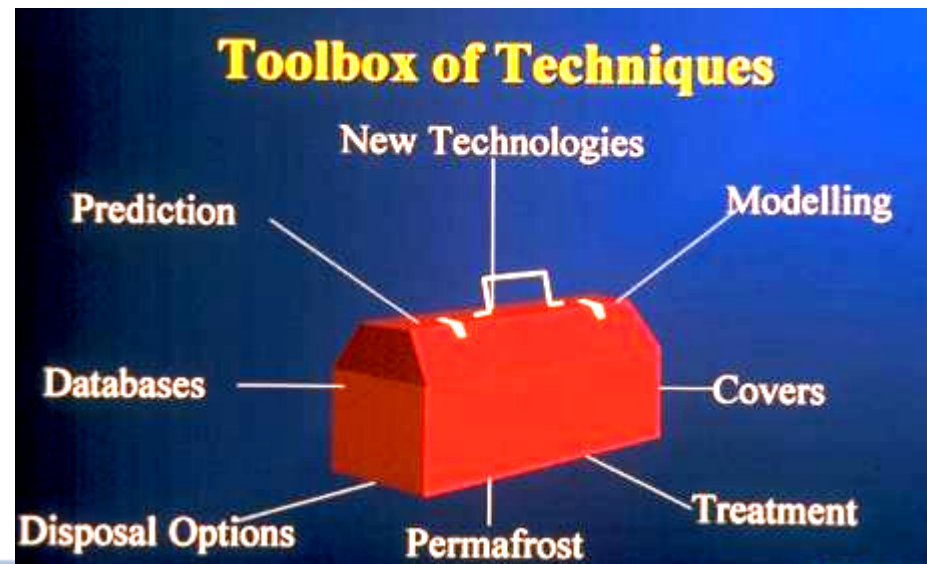
- Prediction techniques
- Water covers for unoxidized and partially oxidized wastes
- Dry covers using soils/tailings, organic materials and geomembranes
- Mine waste management options for tailings, waste rock and treatment sludges
- Active and passive treatment
- Cold climate issues (permafrost)

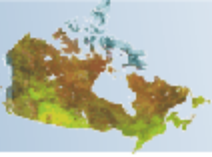




MEND Results

- Toolbox of methods to reduce environmental impacts of mining
 - Prevention best strategy
 - Increased understanding of acidic drainage (AD)
- Consensus building among government, industry and NGOs
- Recognition for Canada's leadership role in addressing AD for metal mines



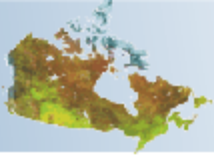


Current Work Plan

Addresses top ranking priorities identified by Canadian experts.

- Closure Management/Case Studies
- Verification of Technologies/Case Studies
- Metal Leaching - Neutral pH
- Passive Treatment
- Sludge Management
- Early Prediction
- Cold Temperature Effects
- Paste Backfill
- Guidance Documents/Manuals





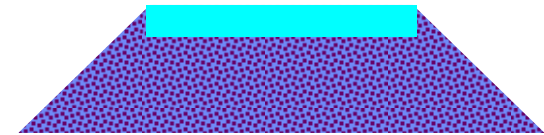
Closure Management (*Tailings*)

Cover Technologies

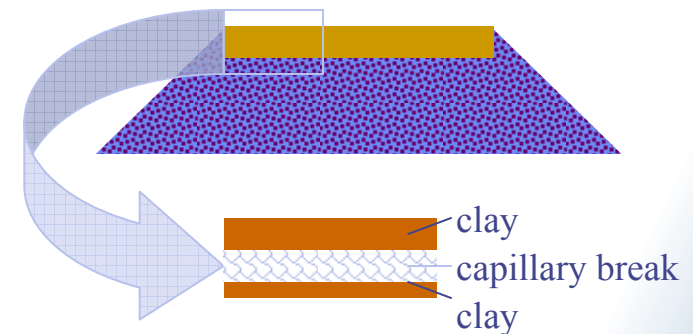
- Soil / Vegetation Cover
- Engineered Dry Covers
- Water Covers
 - Saturation (elevated water table)

Isolation of reactive mine waste

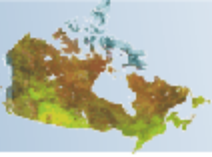
- Separation and segregation
- Backfilling (in-pit) and co-disposal
- Permafrost



Water covers



Dry covers



Engineered Dry Covers

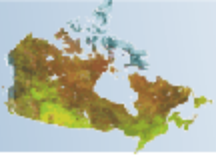
Objectives

- Control the ingress of oxygen
 - High saturation layer
 - Multilayer design
- Control water infiltration
 - Low permeability layer
 - Store and release of moisture

Types of Covers

- Soil/Tailings
- Organics
 - Wood waste, peat, municipal waste
 - Oxygen consuming barrier
 - Availability/economics site specific
 - Longevity
- Geomembranes





Engineered Dry Covers

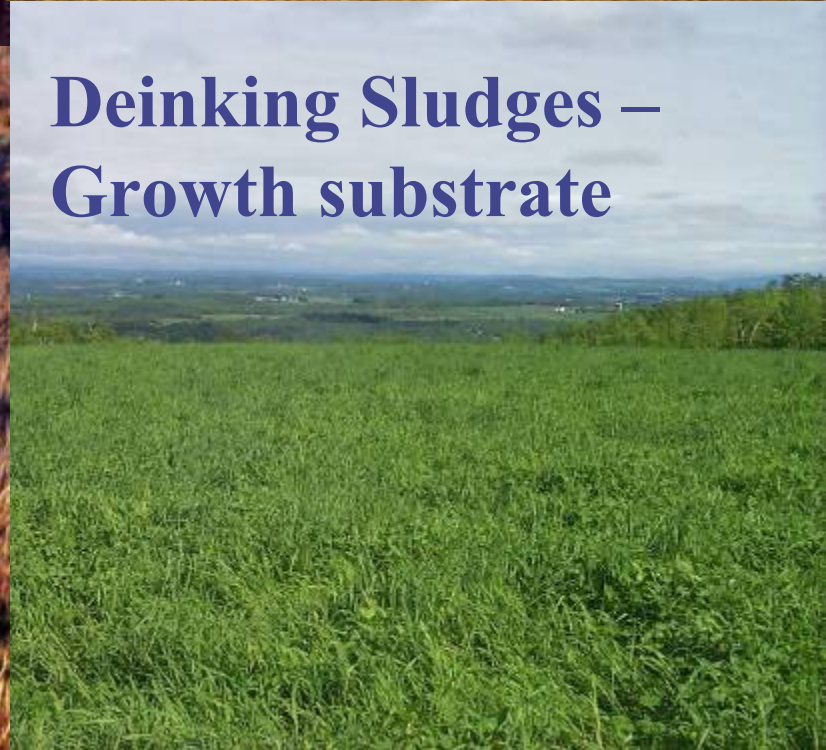


Equity Silver Mine, BC





Albert Mine, QC



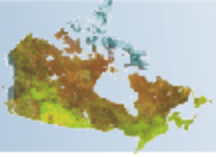
Deinking Sludges – Growth substrate



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CANMET Mining and Mineral Sciences Laboratories



Poirier 1998 - 2001

**Unique solution using
existing liner technology**

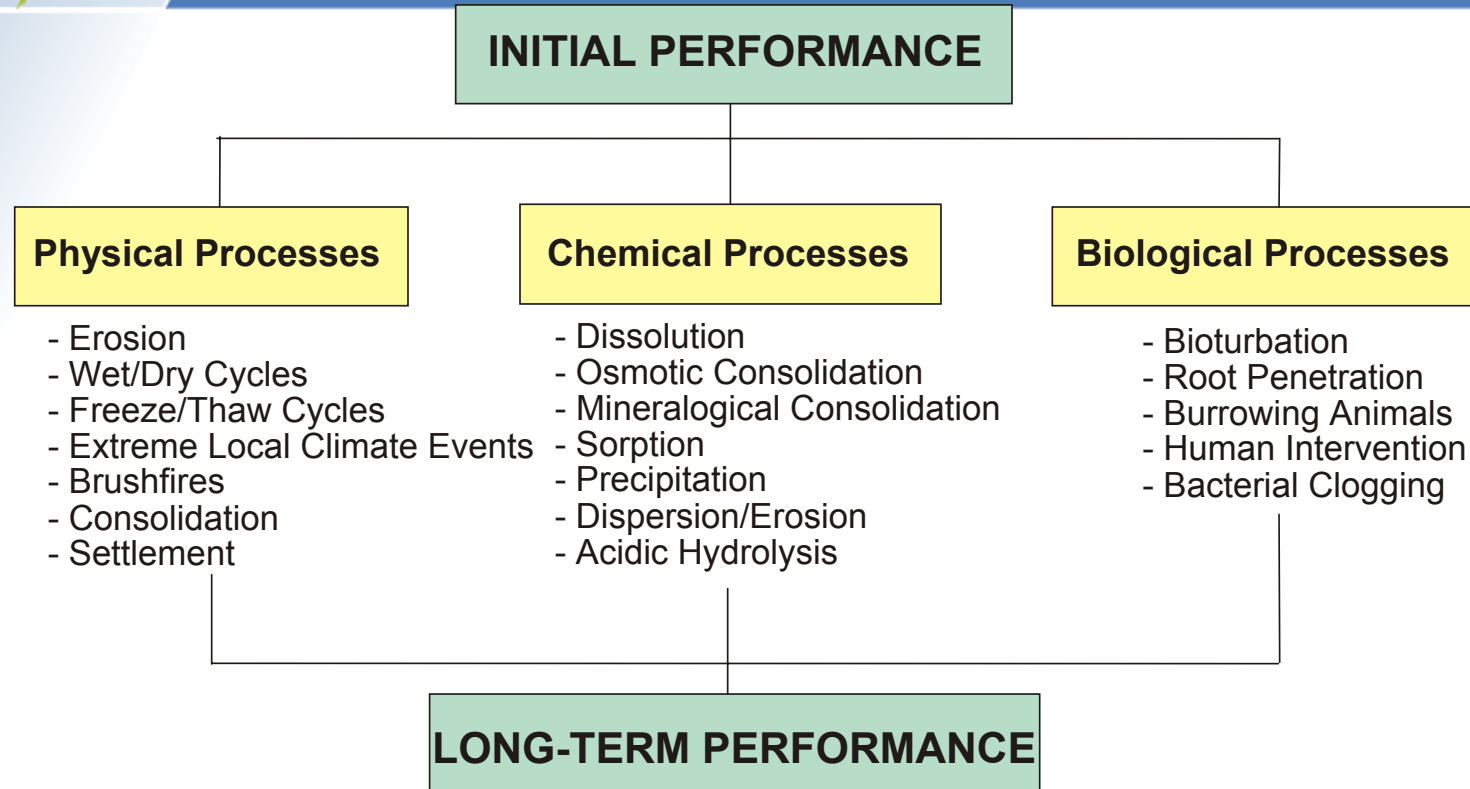


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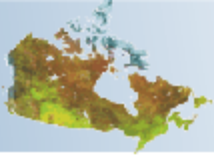
FACTORS AFFECTING COVER PERFORMANCE



Resulting In:

- ***Change in Field Hydraulic Conductivity***
- ***Change in Moisture Retention Characteristics***
- ***Change in Oxygen Diffusion Characteristics***
- ***Change in Physical Integrity of Cover System***





Dry Cover Manuals

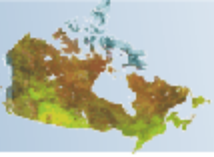
Dry Covers Manual (**Micro-scale**)

5-volume set available in hard copy or CD-ROM:

1. Summary
2. Theory and Background
3. Site Characterization, and Numerical Analyses of Cover Performance
4. Field Performance Monitoring, Sustainable Performance of Cover Systems
5. Case Studies

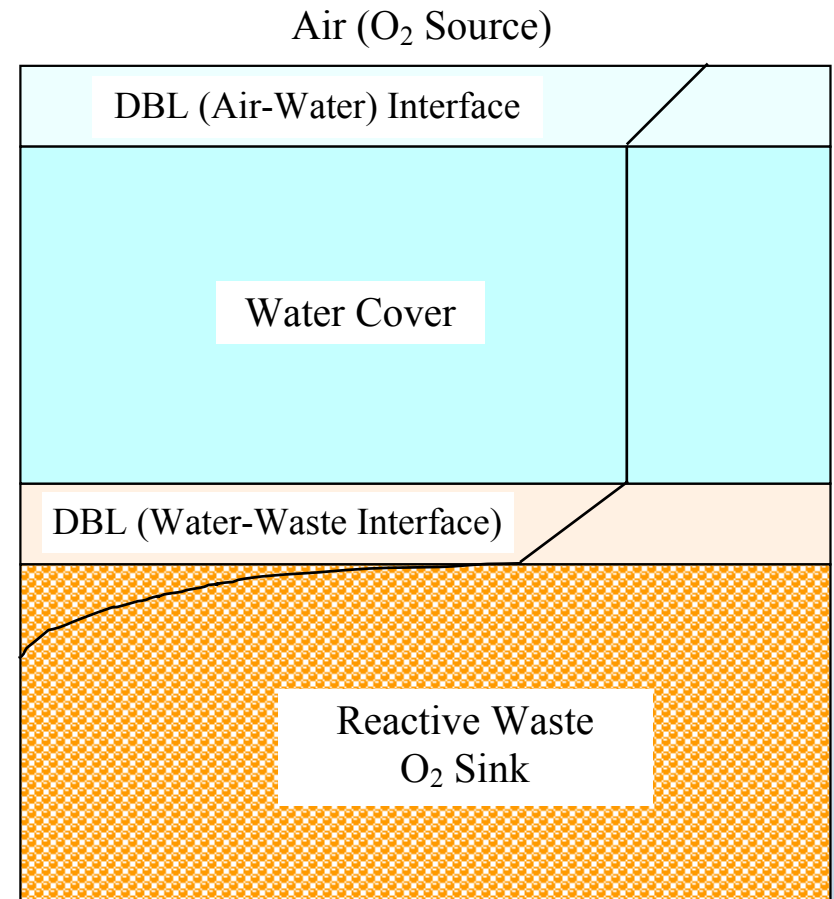
Macro-Scale Cover Design and Performance Monitoring Manual (MEND 2.21.5)

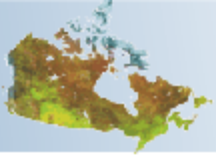




Water Covers

- Water covers - oxygen limiting
- Diffusion barrier to both oxygen in the water cover and contaminants in the submerged waste
- Development of Diffusion Barriers Layers (DBL) at the water-waste and water-air interfaces





Water Cover Sites – Man Made Impoundments



Panel



Quirke

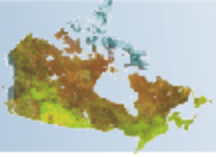


Stanleigh



Nordic/Lacnor





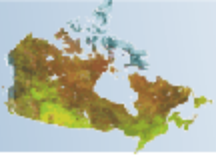
CANMET Mining and Mineral Sciences Laboratories



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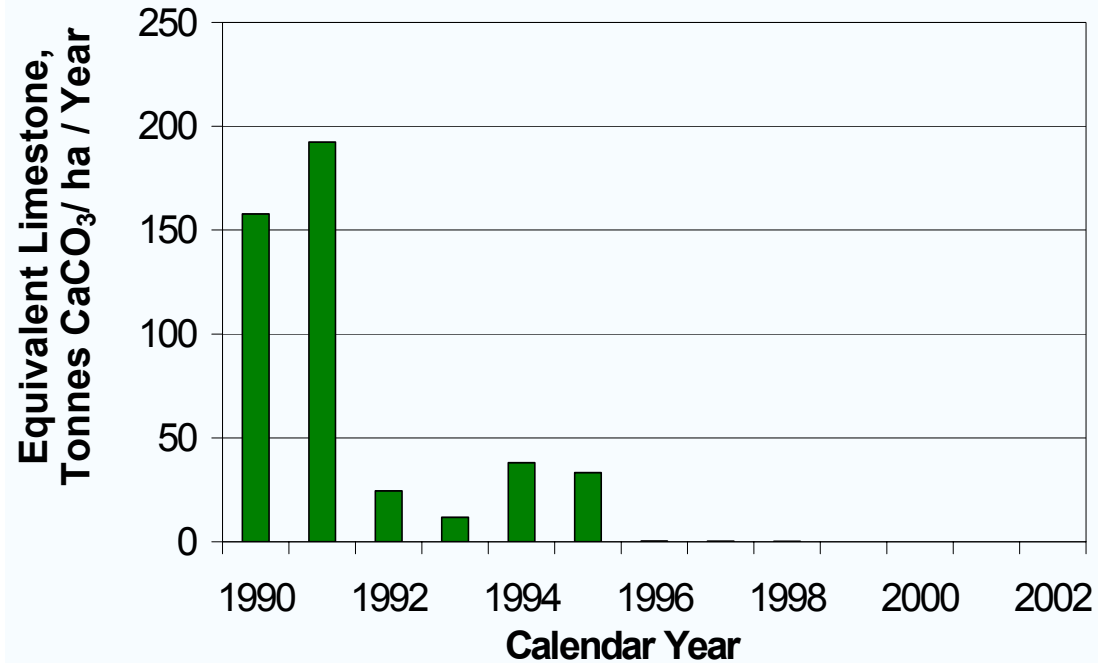
Canada 

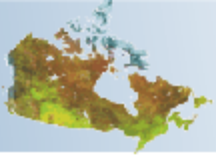


Performance of In-situ Water Covers - Denison TMA

Year	Total CaCO ₃ Equivalent (tonnes/year)	Total CaCO ₃ Equivalent (tonnes/ha/year)
1990	42,779	157.858
1991	52,119	192.320
1992	6,636	24.487
1993	3,201	11.813
1994	10,288	37.963
1995	9,024	33.300
1996	74	0.275
1997	59	0.218
1998	18	0.065
1999	1	0.002
2000	1	0.002
2001	2	0.006
2002	0.16	0.001

Denison TMA-1& 2
Yearly Total Limestone Consumption (1990-2002)
Per Unit Area

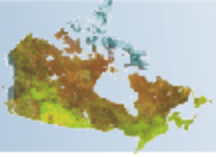




Water Covers – Man Made Impoundments

Louvicourt Mine, QC





Louvicourt - Results

- Shallow water covers are effective
- Oxygen penetration typically less than 1cm
- Overall effect of periphyton biofilm positive

MEND 2.12.2 Long Term Performance of a Shallow Water Cover to Limit Oxidation of Reactive Tailings at Louvicourt



Solbec



FIND THE MINE



Louvicourt

**Man-made
Impoundments –
Water covers**

Equity Silver



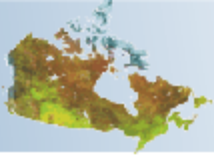
Heath Steele



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MEND Projects - Mine Water Treatment Technologies

Chemical Treatment Technologies

- Acidic and Neutral Effluents
- As, Se and Mo Impacts & Removal

MEND Reports

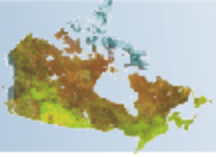
3.42.3 Review of Disposal, Reprocessing and Reuse Options for Acidic Drainage Treatment Sludge

10.1 Review of Water Quality Issues in Neutral pH Drainage

10.1.1 Environmental Management Criteria for Se and Mo

3.15.1 Application of Membrane Separation Technology to Mitigation of Mine Effluents and Acidic Drainage

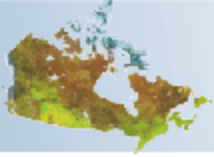




MEND Projects - Mine Water Treatment Technologies

- Neutralization Sludge Characterization
To investigate the geochemical stability of sludge disposed of in pit-lakes
- Treatment Plant Survey
Over 100 surveys received – nationally and internationally. Data being analyzed.





Case Studies and Post-Closure Management

List of Factors to Consider in ML/ARD Assessment and Mitigation (MEND 5.10E/F)

Case Studies in BC (MEND 9.1CD-ROM)

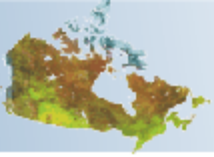
- Johnny Mountain Mine
- Snip Mine
- Sulphurets Mine

Near completion....

Case Study Assessment (CD)

- Dona Lake, ON (Placer Dome)
- Heath Steele, NB (Falconbridge)
- Mandy Lake, MB (HBMS)
- East Kemptville (BHP Billiton)
- Mine Poirier (BHP Billiton)





MEND Projects

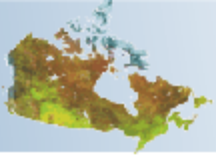
MEND 1.70.1

Investigations of Predictions for Acidic Drainage at the Vangorda Plateau, Faro Mine Complex – Faro, YT

MEND W.019

Proceeding of the
MEND Manitoba Workshop
(Winnipeg, June 2008)

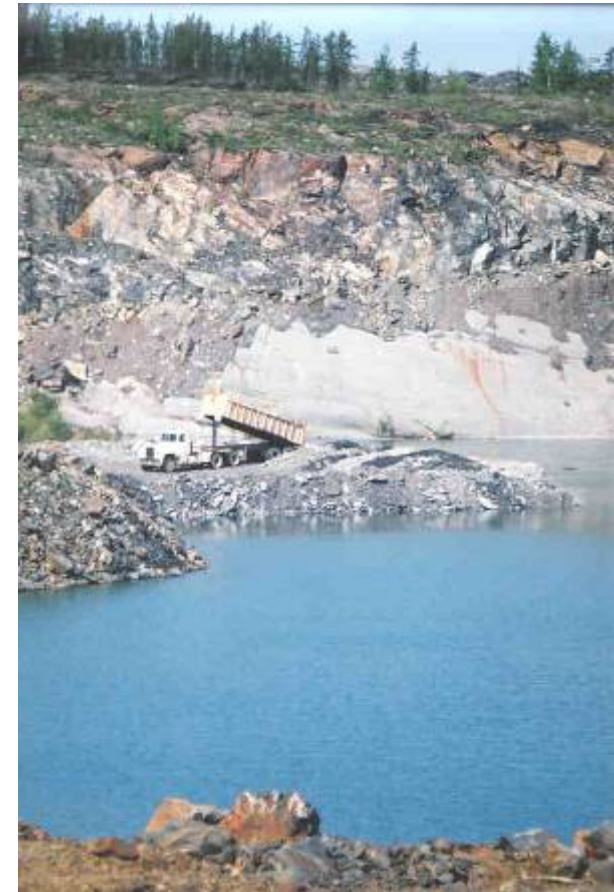


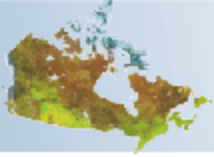


MEND Project - Underway

Case Study Review of In-Pit Disposal of Tailings and Waste Rock (SENES)

- Update MEND 2.36.1 report completed in 1995.
- 15 case studies to be detailed based on available information





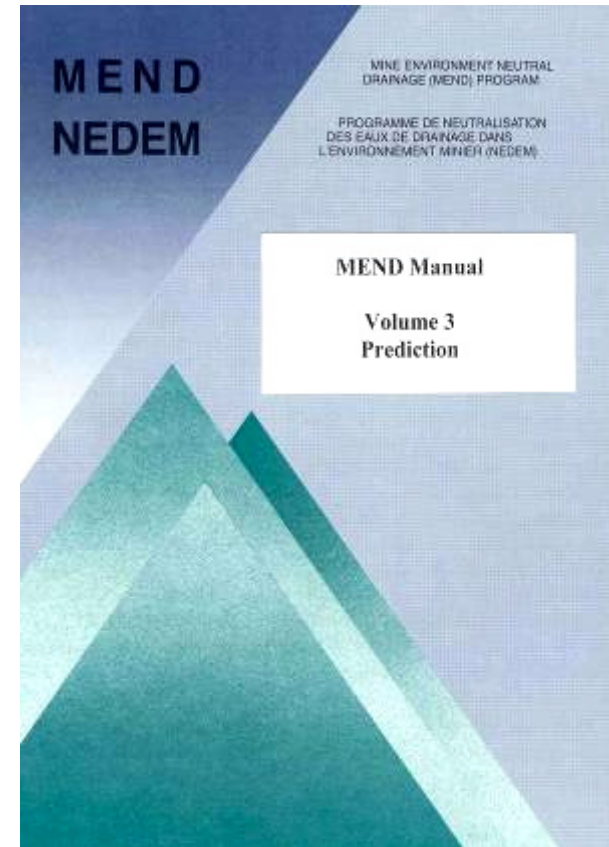
X-cutting - Guideline Documents

MEND Manual (MEND 5.4.2) (2002)

- Volume 1: Summary
- Volume 2: Sampling and Analyses
- Volume 3: Prediction
- Volume 4: Prevention and Control
- Volume 5: Treatment
- Volume 6: Monitoring

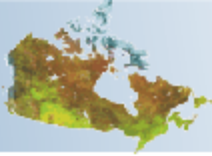
In Progress....

Prediction Manual - Update of the Draft “BC Prediction Manual” to be published as national document (NRCan)



Also available on CD





X-Cutting – Technology Transfer

The MEND Monitor Workshops (>30)

- Annual BC/MEND ARD/ML Workshops
- Sudbury (2004); Halifax (2006); Winnipeg (2008)
- MEND Technology Transfer Workshops to Community Groups
- Symposium 2008 – Rouyn Noranda

MEND Website at: mend.nrcan.gc.ca

MEND Reports (>210)

MEND Manual

Global Alliance

- GARD Guide



The MEND Monitor

The Mining Association of Canada (MAC)
The Mining Association of Canada (MAC) is the national organization of the Canadian mining industry. It comprises companies engaged in mineral exploration, mining, smelting, and processing.

MEND Publications
MEND Report 4.6.1.8 - Update on Cold Temperature Effects on Biochemical Weathering Effects of Gold Tailings on Iron Bacteria and Microalgae, along with associated biogeochemical changes. Research case histories are reviewed and discussed to better understand geochemical interactions. Conference proceedings are disseminated through the MEND website and communication made to Universities. Conference 2008 - Cold Temperature Effects on Biochemical Weathering of Gold Tailings on Iron Bacteria and Microalgae. Vancouver, October 23-25, 2008. The focus of the presentations was on the challenges and opportunities for research in this area and subsequent workshop. (2008) For the proceedings, see www.mend.nrcan.gc.ca

Upcoming Events
April 2009 - Canadian Mine Reclamation Symposium, September 11-12, 2009 - Vancouver, BC. The theme is Reclamation through Innovation and Change for CMRA. The program will include a full day tour of the Strathcona Mine and associated facilities for additional information on the technical program, health and registration.

February 2009 Mining and the Environment Conference, October 23-25, 2009 - Sydney, ON. The conference will address mine reclamation and environmental protection issues with a focus on sustainability. www.mend.nrcan.gc.ca

April 2009 MEND Workshop - Vancouver 20-23, 2009 - Vancouver, BC. To be held in conjunction with the International Mine Water Association - Tailings Process Challenges in Selection and Reclamation of Tailings.

Symposium on Water, Air and Land Sustainability Issues in Mineral and Metal Extraction, August 24-25, 2009 - Winnipeg, MB. For additional information, visit www.mend.nrcan.gc.ca

For more information, please contact MAC's web site: www.mend.ca

For citation information on MEND or its publications, please visit the web site at: www.mend.nrcan.gc.ca or send an e-mail to: "mend_monitor@nrc.ca"

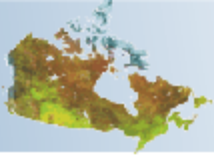
Canada



Natural Resources Canada

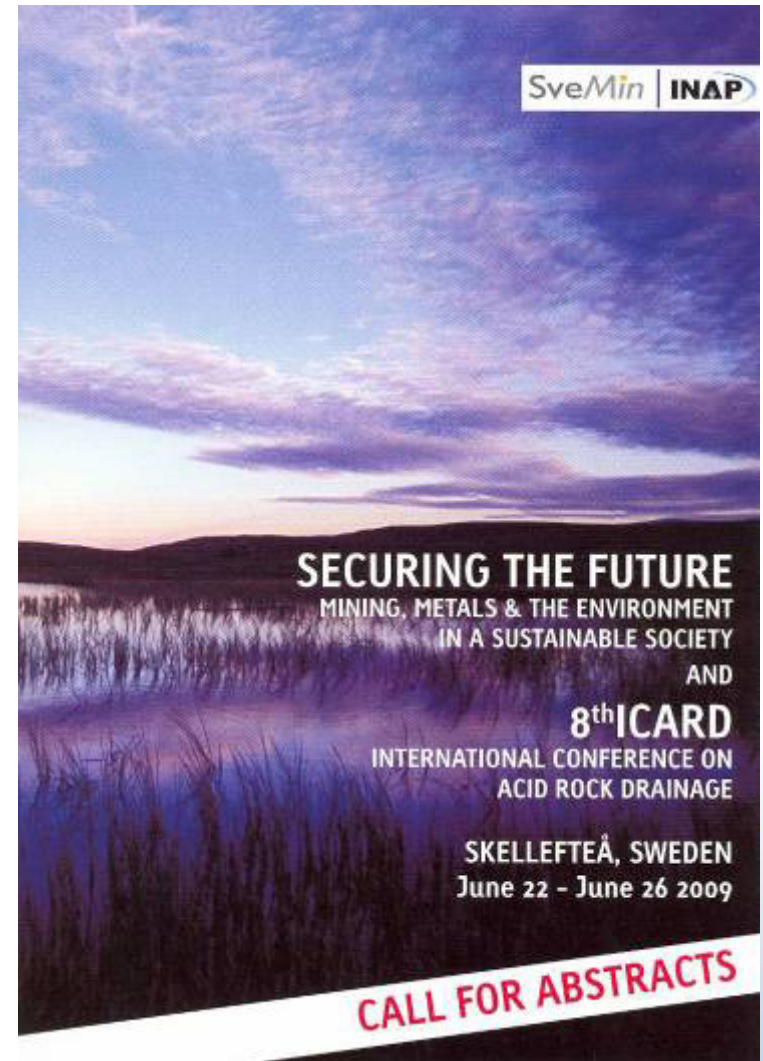
Ressources naturelles Canada

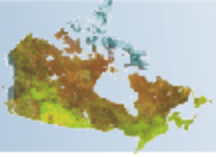




8th International Conference on Acid Rock Drainage

Skellefteå, Sweden
June 22-26, 2009



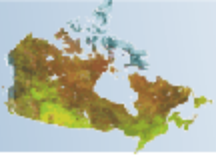


National Orphaned / Abandoned Mines Initiative - (NOAMI)



White Lake Mine – HBMS (Manitoba)

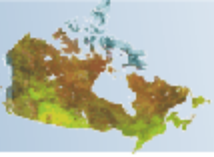




- Multistakeholder partnership
- Five task groups overseeing prioritized projects:
 - Information Gathering (Inventory)
 - Community Involvement
 - Barriers to Collaboration
 - Funding Approaches
 - Jurisdictional Legislative Review

www.abandoned-mines.org



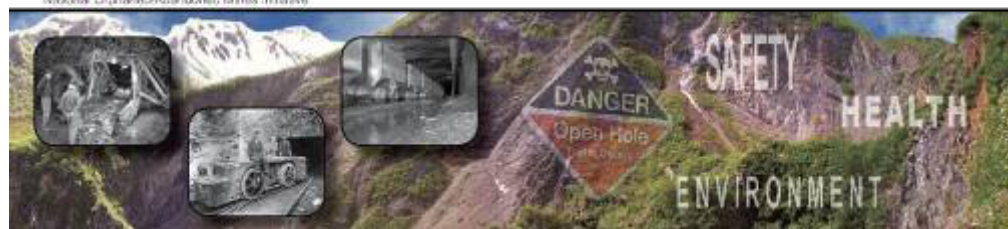


National Inventory

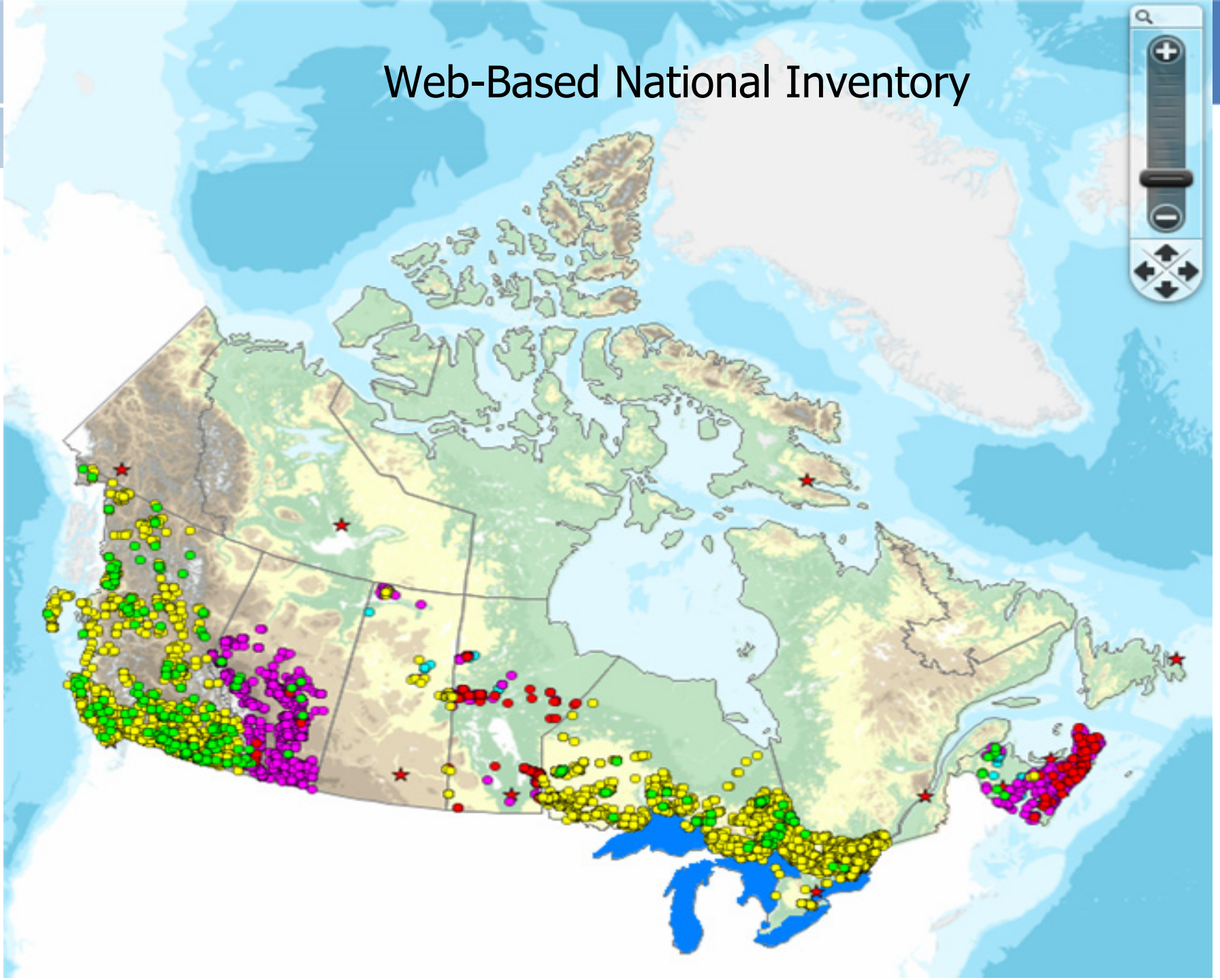
- Good progress on web-based national inventory
- Data missing from a few jurisdictions
- Classification of data and definitions need to be revisited
 - Revise focus from legal based to feature based
- Proposal for possible path forward received from CalData

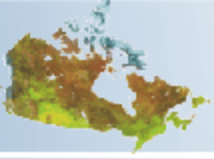


www.abandoned-mines-inventory.org



Web-Based National Inventory

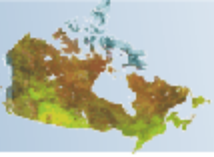




Community Based Pilot Project

- Objective is to build local capacity to understand the issues with respect to abandoned mines
- Toolkit to be produced which will be modular and adaptable to the needs of different communities
- Pilot project to be conducted at three diverse communities
 - Virginiatown (ON); Chibougamau (QC); and Ymir (BC)
 - Contract awarded to CIER (Centre of Indigenous Environmental Resources)

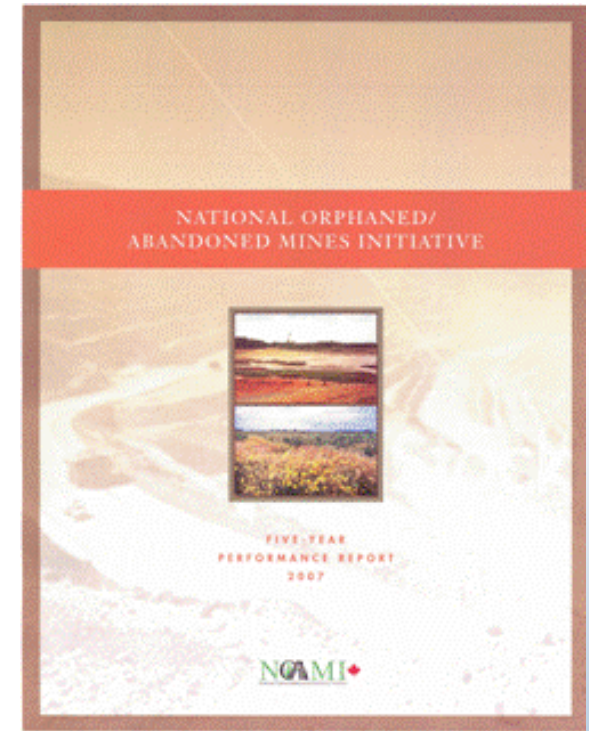


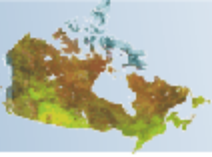


Communication Strategy

Performance Report (2002 – 2008) in final stage of preparation

- Report outlines the impacts and benefits of NOAMI, the accomplishments of the jurisdictional partners, role of stakeholders and the remaining challenges
- Should be available in both official languages in early 2009.

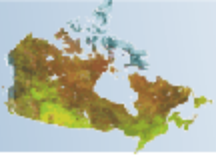




Workshop to Explore Perspectives in Risk Assessment

- Broad spectra of perspectives to be integrated through presentations and discussion by government, industry communities, practitioners, NGOs and Aboriginal Canadians
- Presentations clustered around 5 themes:
 - Risk Assessment Planning Process
 - Human Health Assessment
 - Ecological Risk Assessment
 - Geotechnical / Safety Risk Assessment
 - Case studies – featuring the good and the bad
- Workshop attended by about 105 delegates (November 13-14, Vancouver).





NOAMI Highlights

- Workshop to Explore Best Practices held Winnipeg, October, 2006.
- A Toolkit of Funding Options Report
- CD-ROM of report on the legislative, regulatory, and policy framework for all jurisdictions in Canada. Available from Secretariat.

Proceedings of the NOAMI Workshop

Winnipeg, Manitoba
October 26 & 27, 2006



Orphaned and Abandoned Mines:
A Workshop to Explore Best Practices

Release Date:
March 2007



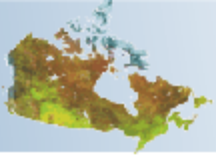
Jurisdictional Legislative Review



Report on the Legislative, Regulatory, and Policy Framework Respecting Collaboration, Liability, and Funding Measures in relation to Orphaned/Abandoned, Contaminated, and Operating Mines in Canada

Release Date:
November 2007





Mine Environment Neutral Drainage (MEND)

mend.nrcan.gc.ca

National Orphaned/ Abandoned Mines Initiative (NOAMI)

www.abandoned-mines.org





Merci
Thank you



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Val d'Or , Québec



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Canada 