Ministry of Energy, Mines and Petroleum Resources

BC is Booming - Is ARD Looming? An Overview of Regulatory Approach and Recent Mining Issues in British Columbia

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BRITISH COLUMBIA

Presentation Outline

- Overview of regulatory approach to ML/ARD issues in BC
- Status of mining in BC
- Examples of mining projects, highlight ML/ARD issues and best practices
- Prediction challenges

ML/ARD Regulation in British Columbia

ML/ARD Regulation in BC - The Challenge

- **How to regulate mining and exploration activities in a way that supports the Provincial goal of resource development, while ensuring the environment is protected, mining lands are reclaimed and the risk and environmental liabilities associated with ML/ARD are minimized.**

Regulatory Guiding Principles

- Ability and Intent
- Site-Specific
- ML/ARD Program
- Prediction and Prevention
- Contingency
- Minimize Impacts
- Cautious Approach
- Reasonable Assurance
- Financial Security

Ability and Intent

- A mining company has to demonstrate its ability and intent to operate a mine in a way that protects the environment.
- Mitigation plans must meet the environmental and reclamation objectives for the site.

Site Specific

Johnny Mountain

Sullivan

Every site is evaluated on a site specific basis.

ML/ARD Program

- **Whenever bedrock or unconsolidated earth will be excavated or exposed, the proponent is responsible for the development and implementation of a ML/ARD prediction and prevention program.**

- **The program must include prediction, prevention, mitigation strategies as well as monitoring programs.**

Kemess South

Prediction and Prevention

Eskay Creek

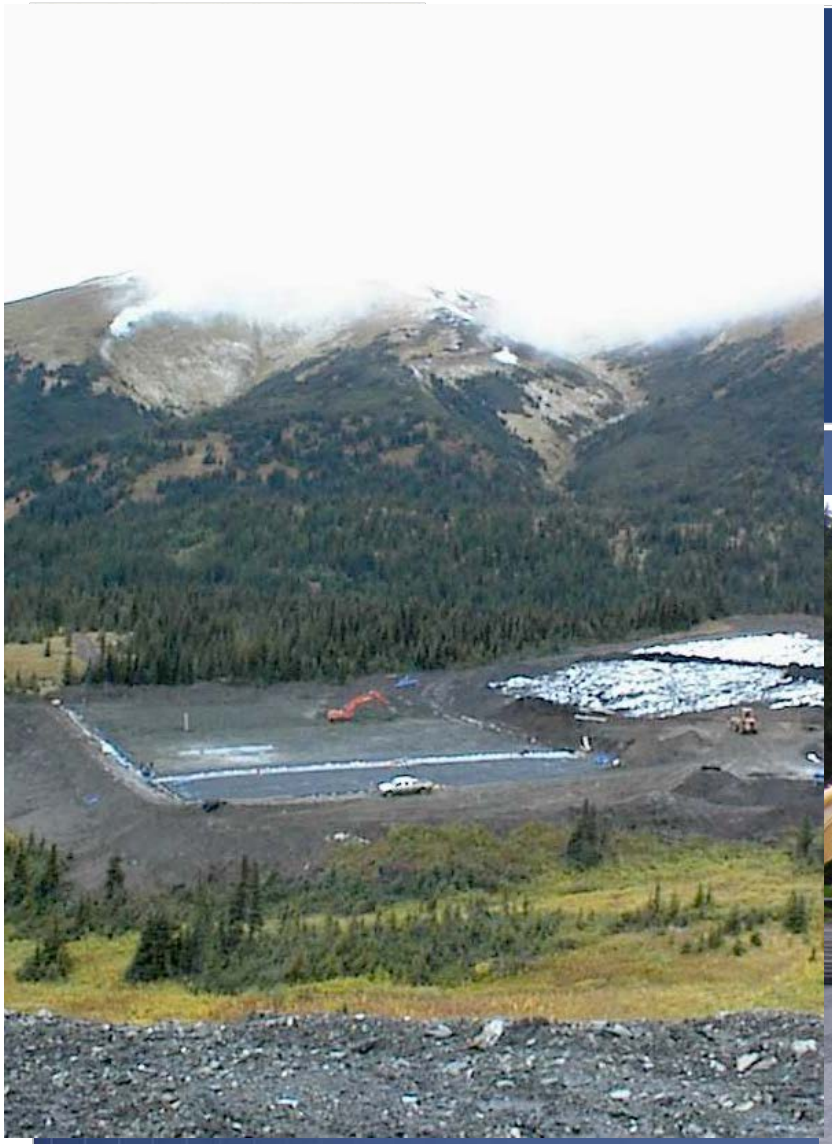
The primary objective of a ML/ARD program is <u>PREVENTION.</u>

This is achieved through prediction and the design and implementation of appropriate mitigation strategies (i.e. sub-aqueous disposal).

Main Mitigation Strategies Used in BC

- Avoidance
- Flooding (water covers)
- Dry Covers
- Blending of Materials
- Drainage Treatment

Every mitigation strategy has strengths and weaknesses and not all strategies are applicable for all mine sites and their environments.



Cirque

Monteith Bay

Contingency

Island Copper

Where there is a high degree of uncertainty or environmental risk involved, back-up plans are required.

Contingency

- **Primary mitigation – segregation and flooding of PAG waste rock**
- **Contingency plan – flood all waste rock**

Minimize Impacts

- **Where ML/ARD cannot be prevented, mines are required to minimize the impacts to the receiving environment.**

- **Potential impacts and risks must be clearly identified during the review process for consideration.**

Cautious Approach

- **The Ministry will exercise a cautious approach when the level of information or understanding is deficient.**

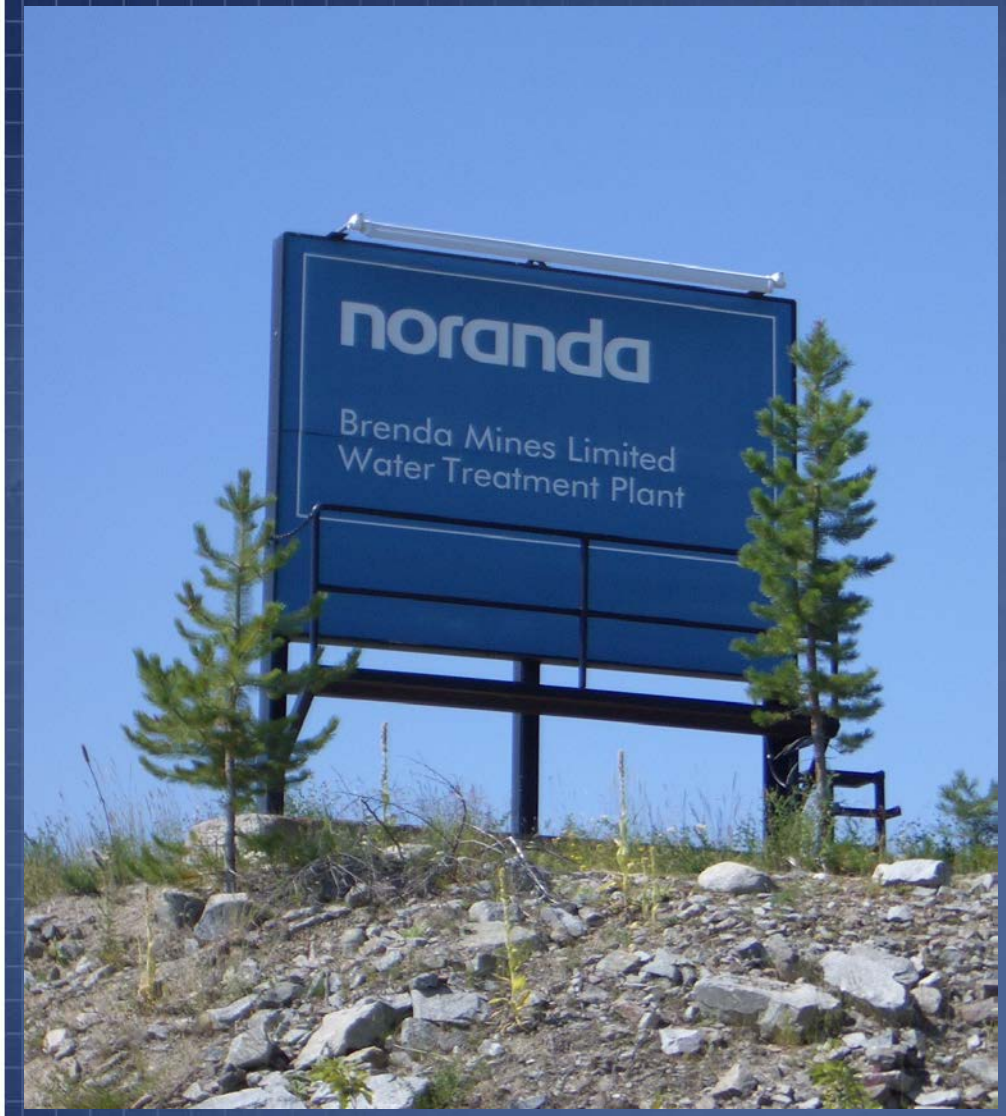
Equity Silver

Reasonable Assurance

- **The Provincial government requires reasonable assurance that the environmental risk is being minimized and that the taxpayers will not be paying for the costs of reclaiming mines and managing ML/ARD.**

Britannia

Financial Security



Brenda Mine

The *Mines Act* requires a financial security that covers the cost of reclaiming a mine and any on-going costs for managing ML/ARD.

This security is raised and lowered throughout the life of a mine to correspond to the level of land disturbance and the cost of reclamation and any mitigation.

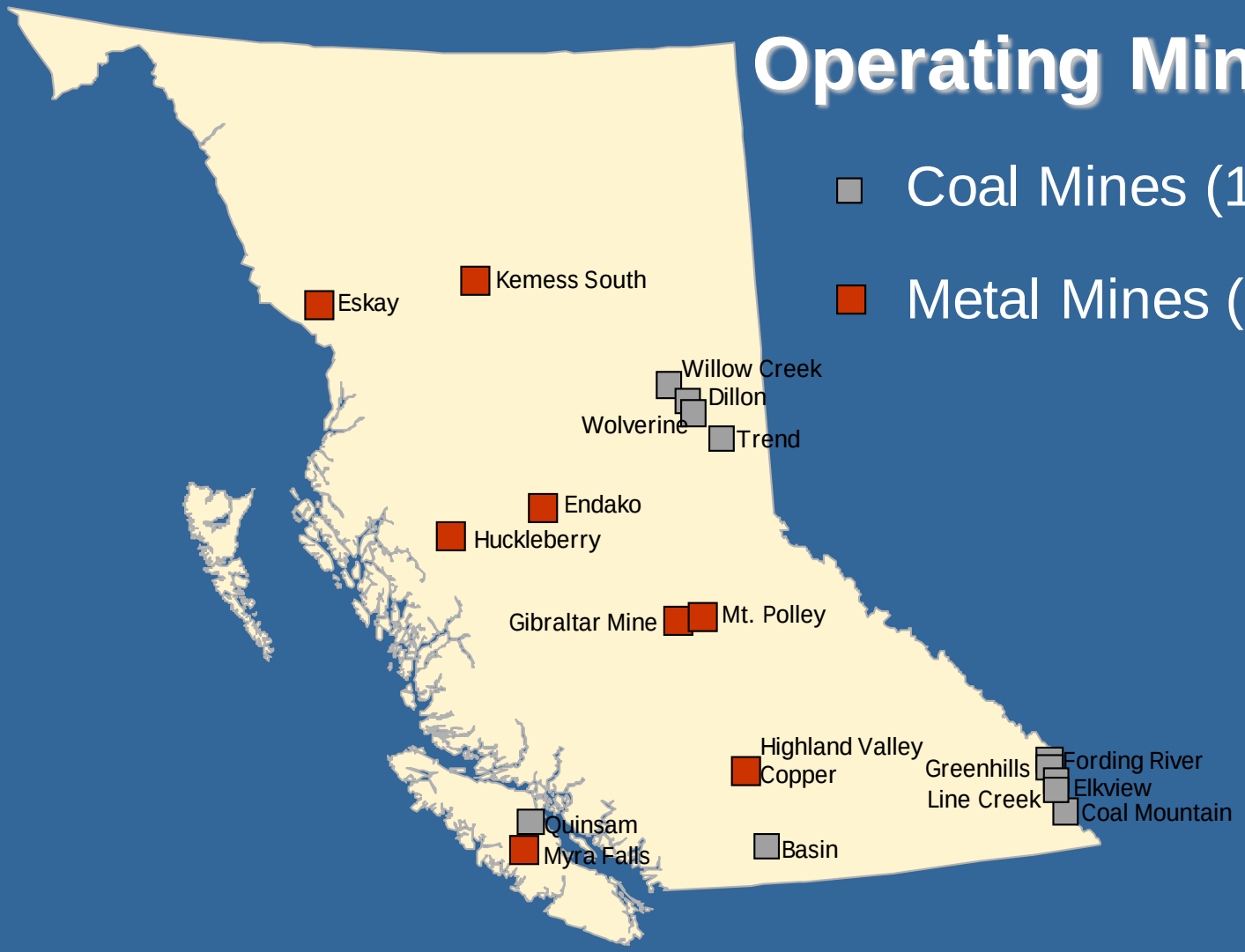
Regulatory Tools and Resources

- ***Mines Act*** **and the Health, Safety and Reclamation Code**
  http://www.em.gov.bc.ca/Mining/Healsafe/mxready/mxcode01.htm
- **BCMEM & MWLAP joint policy on ML/ARD**
  http://www.em.gov.bc.ca/Mining/MinePer/ardpolicy.htm
- **ML/ARD Guidelines**
  http://www.em.gov.bc.ca/Mining/MinePer/ardguide.htm
- **Draft ML/ARD Prediction Manual**
  http://www.mndm.gov.on.ca/mndm/mines/mg/leg/BC%201997%20Draft%20Guideline.pdf

Status of Mining

Operating Mines

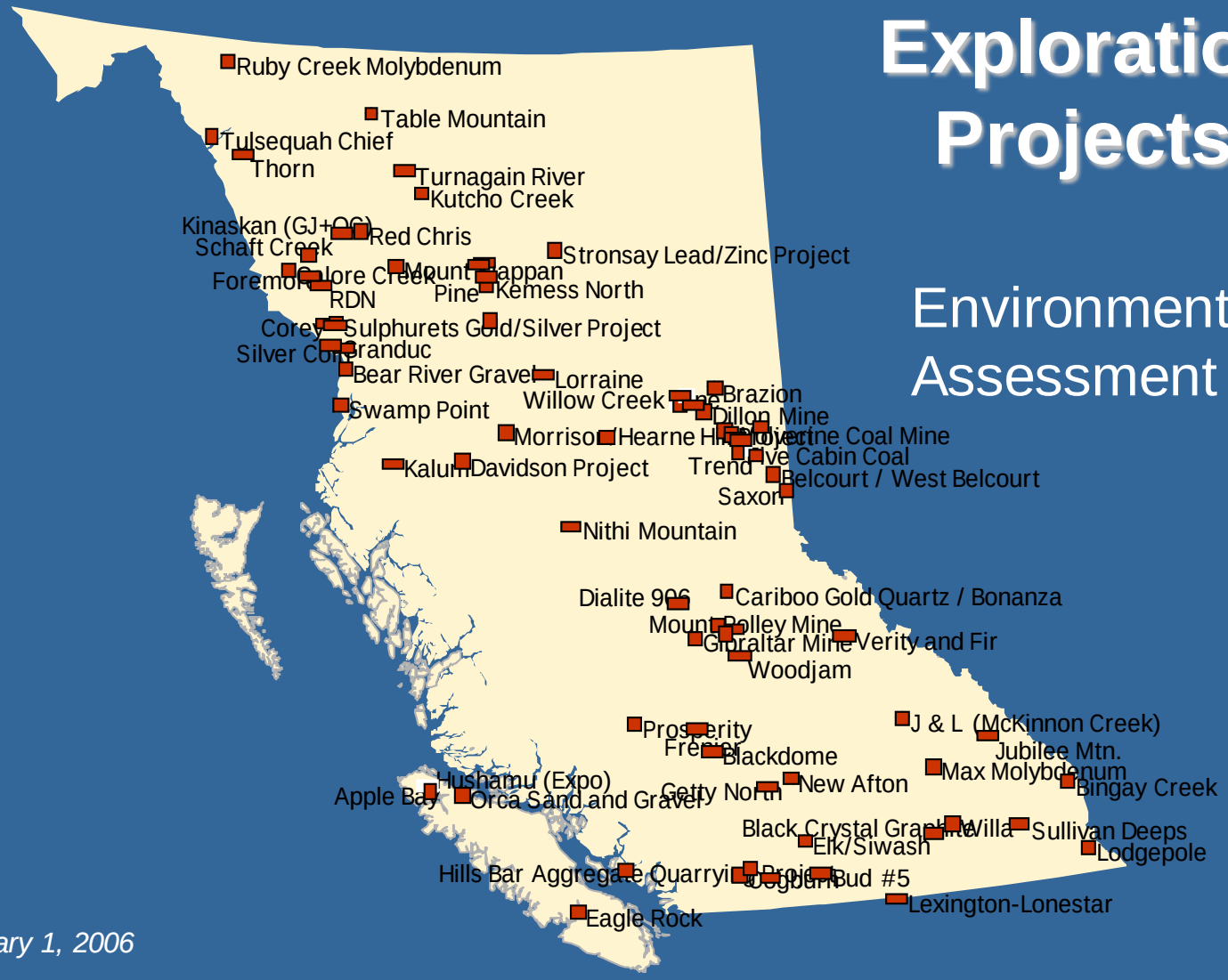
- Coal Mines (11)
- Metal Mines (8)



May 15, 2006

Advanced Exploration Projects

Environmental Assessment (18)



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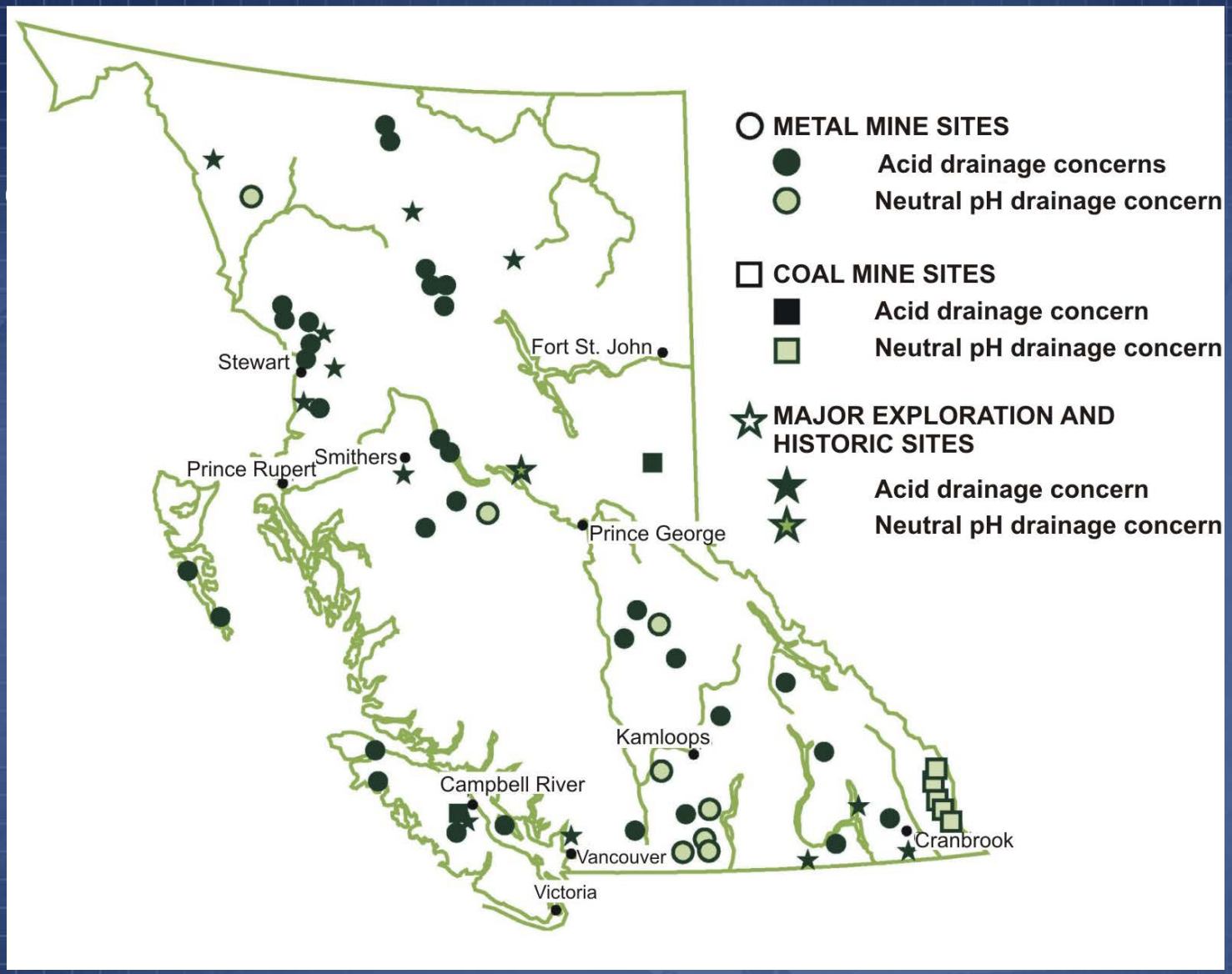


Mitigation of ML/ARD at Mine Sites in British Columbia

Project Highlights, Best Practices and Challenges

General Project Trends

- Several projects are setting a new bar for applications
- Longer baseline periods (1-2 years) for water quality and ML/ARD prediction work
- Environmental management plans initiated from the planning phase

BRITISH COLUMBIA

Galore Creek – EA Application

Galore Creek – in EA Review

- **Porphyry Cu-Au**
- **516 MT ore**
- **Grades 0.59%Cu, 0.36 g/t Au and 4.54 g/t Ag**
- **Ore throughput of 60,000 tpd with mine life of 20 years**
- **Will create 500 Mt of tailings and 1 Bt waste rock**

Photo From EA Project Description, December 2004, Rescan

Galore Creek –Key Issues

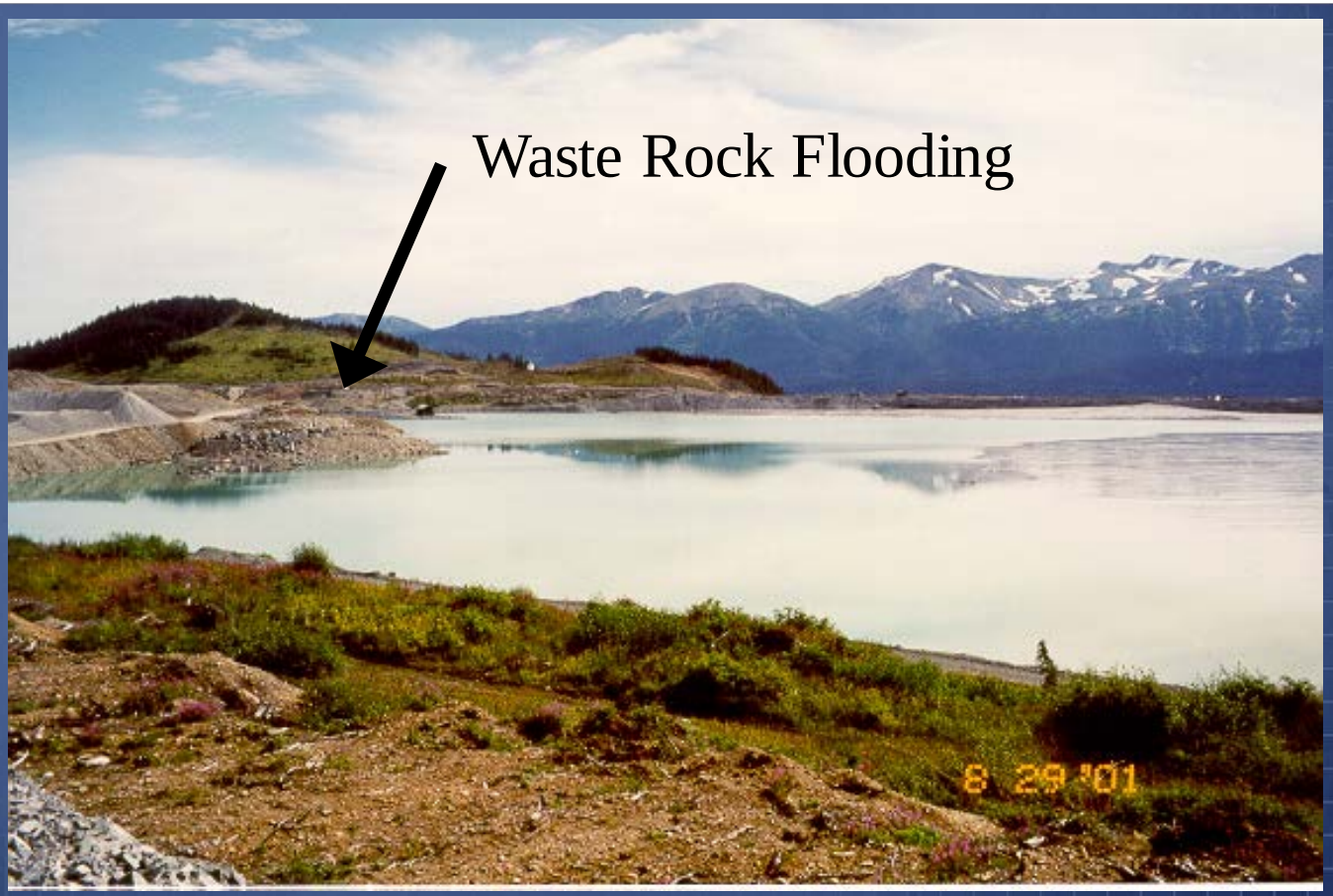
- **ML/ARD**
- **Hydrology and large positive water balance for the impoundment**
- **Road Access**
- **First Nations Issues & Relationships**

Photo From Updated EA Project Description, June 2005, Rescan

ML/ARD Best Practices - Water Covers

Huckleberry

ML/ARD Best Practices
- Flooding prior to onset of ML/ARD



Huckleberry

ML/ARD Best Practices - Segregation

ML/ARD Best Practices - Mine Scheduling and Backfilling

Huckleberry

QR Gold

Many New and Proposed Coal Mines

- **ARD**
- **Neutral pH selenium leaching**

Wolverine Coal

Mitigation – Thin Mixing with Excess NP

Trend Small Mine

ARD potential generally limited to thin strata and near seam impurities which can concentrate in coarse coal refuse

Bulk of the strata has high NP

Management focuses on identification and ensuring thinly dispersed and mixed with high NP strata

Mitigation - Avoidance

Wolverine Coal

Large AG/PAG unit removed from mine plan

Selenium Leaching

Fording River - 1 of 5 Elk Valley Coal Mines

- **Increasing Se trends in Elk River**
- **Se is an essential element but can be toxic to fish and birds at high concentrations**
- **Prompted creation of Task Force to examine sources, release mechanisms, biological effects and determine whether treatment and or management is required now or in future**

Selenium Facts

- Low levels occur in all strata, typically 2-8 ppm Se
- Leaching occurs from all mine materials, but can be slightly higher from fine grained lithologies
- Complex mineralogy since Se substitutes for S; several release mechanisms possible (sulphide oxidation, sulphate dissolution)
- Dietary uptake is primary pathway for toxicity, so water quality guidelines appropriate as indicator
- Slow moving water environments are generally more susceptible to selenium toxicity

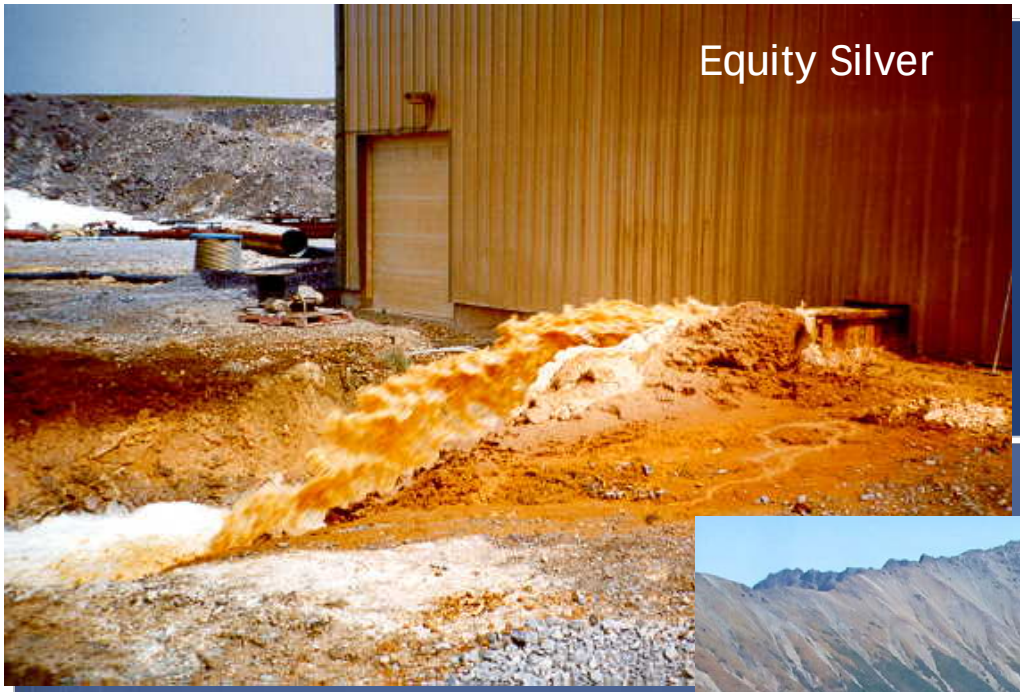
Elk Valley Selenium Task Force - Findings to Date

- Negligible risks to human health from fish consumption
- Initial studies suggest some possible effects to birds, fish and frogs in the highest selenium areas, but currently no evidence of large-scale negative impacts.
- Predicted future water quality in the Elk River is not know
- The need for selenium treatment and management is not known
- Currently no readily available, off-the-shelf technology to treat selenium in water
- Research is ongoing

Selenium Management - New Coal Mines

- Proactive prediction of water quality
- Good Se baseline with on-going biological and geochemical monitoring
- Implementing measures to reduce selenium levels (selective placement)
- Mitigation includes eliminating pathways to sensitive areas of the environment if negative effects are detected (drainage routing)

Challenges – Long Term Management, Maintenance



Many mitigation strategies must be designed to last forever.

Need systems to transfer site info and track performance

Challenges – Dynamic and Evolving Minesites and Environments

Challenges – Performance Uncertainties

Equity Silver

Many ML/ARD mitigation technologies are relatively new

- **limited performance histories**
- **performance uncertainties**

Challenges – Residual Issues

- **Pit lake management**

Proposed Kemess North Pit

Bell and Granisle Pits

Challenges – Residual Issues

Sludge management

- Volume can rival original waste
- Physical containment challenges
- Long term chemical stability uncertainties

Samatosum

Challenges – Evaluating Long Term Liabilities

Samatosum

Equity Silver

Challenges - Prediction

- **Inherent limitations of static and kinetic testing procedures**
- **Scaling up**
- **Representative samples**
- **Lag times**
- **Quantifying silicate NP**

Kemess South

In Summary

- **BC is booming!**
- **But is ML/ARD looming?**

Is ML/ARD Looming?$$$$$

- **BC's approach to proactive prediction, prevention and mitigation should help to reduce environmental liabilities associated with ML/ARD as much as possible.**
- **But some mines will have residual ML/ARD issues at the end of mining and many mines will have ongoing mitigation, monitoring and maintenance requirements**


Thank-you!