PANEL DISCUSSION

Challenges / Solutions / Tools and Research Needs: What uncertainty exists? How do you deal with it? What new tools and research would you like to see developed?

Ron Nicholson,
EcoMetrix Incorporated

21st BC MEND ML-ARD Workshop Vancouver, 3-4 December 2014

Early Identification of Issues in Canada focused on Milling and Tailings at Metal Mines

MINE WASTE CONTROL

IN

ONTARIO

BY

John R. Hawley
Head, Mining and Metallurgy Unit
Industrial Section
Waste Management Branch
Ontario Ministry of the Environment
135 St. Clair Avenue West
Toronto, Ontario
Canada

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Efforts since the 1970s

- Reactive Acid Tailings Stabilization (RATS) – early 1980s
- National Uranium Tailings Program (NUTP) – mid 1980s to 1989
- Mine Environment Neutral Drainage (MEND) Program – major funding 1989 to 1997
- International Network for Acid Prevention (INAP) -

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Important Milestones

The GARD Guide - An initiative of the International Network for Acid Prevention (INAP)

CANMET Mining and Mineral Sciences Laboratories

Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials

Report prepared by:

William A. Price
CANMET- Mining and Mineral Sciences Laboratories
Smithers, British Columbia
V0J 2N0

2009

Work performed for:
MEND Program

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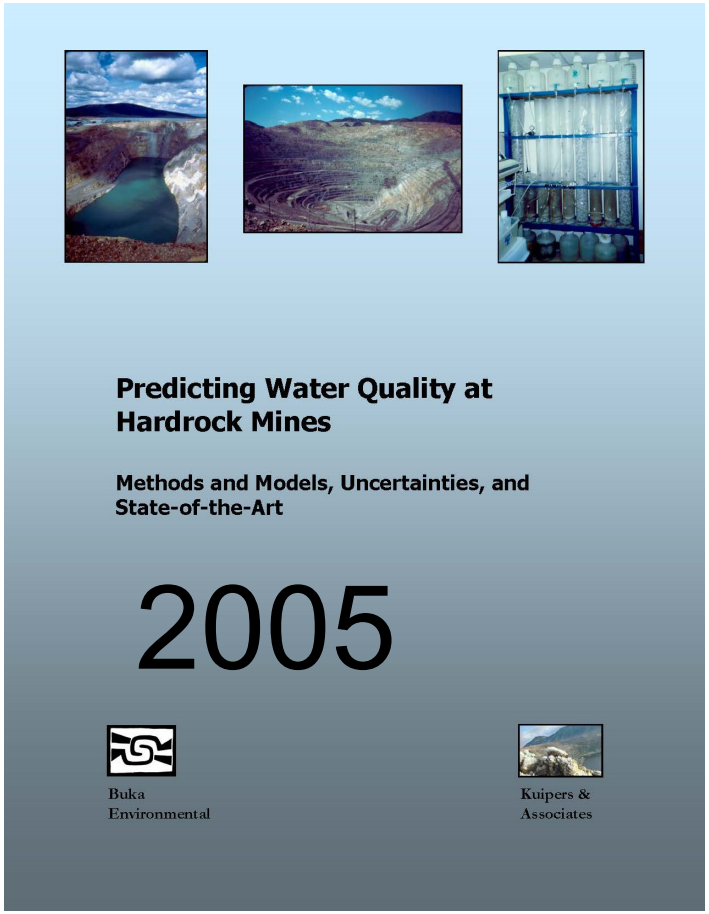
Prediction Success / Failure



Assessed 50 case studies at metal mines with EA Predictions

Maest, Kuipers, Travers and Atkins

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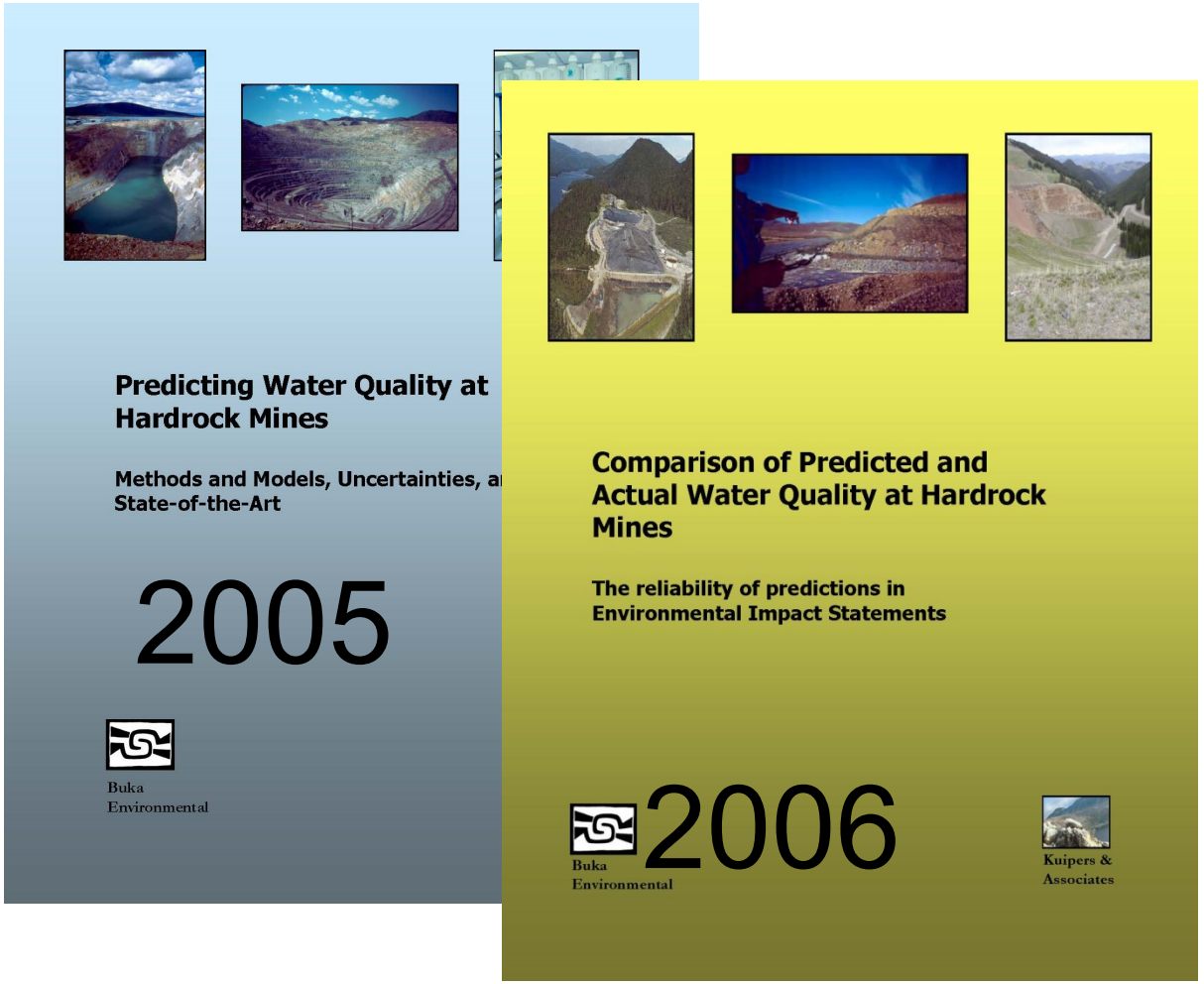
Prediction Success / Failure



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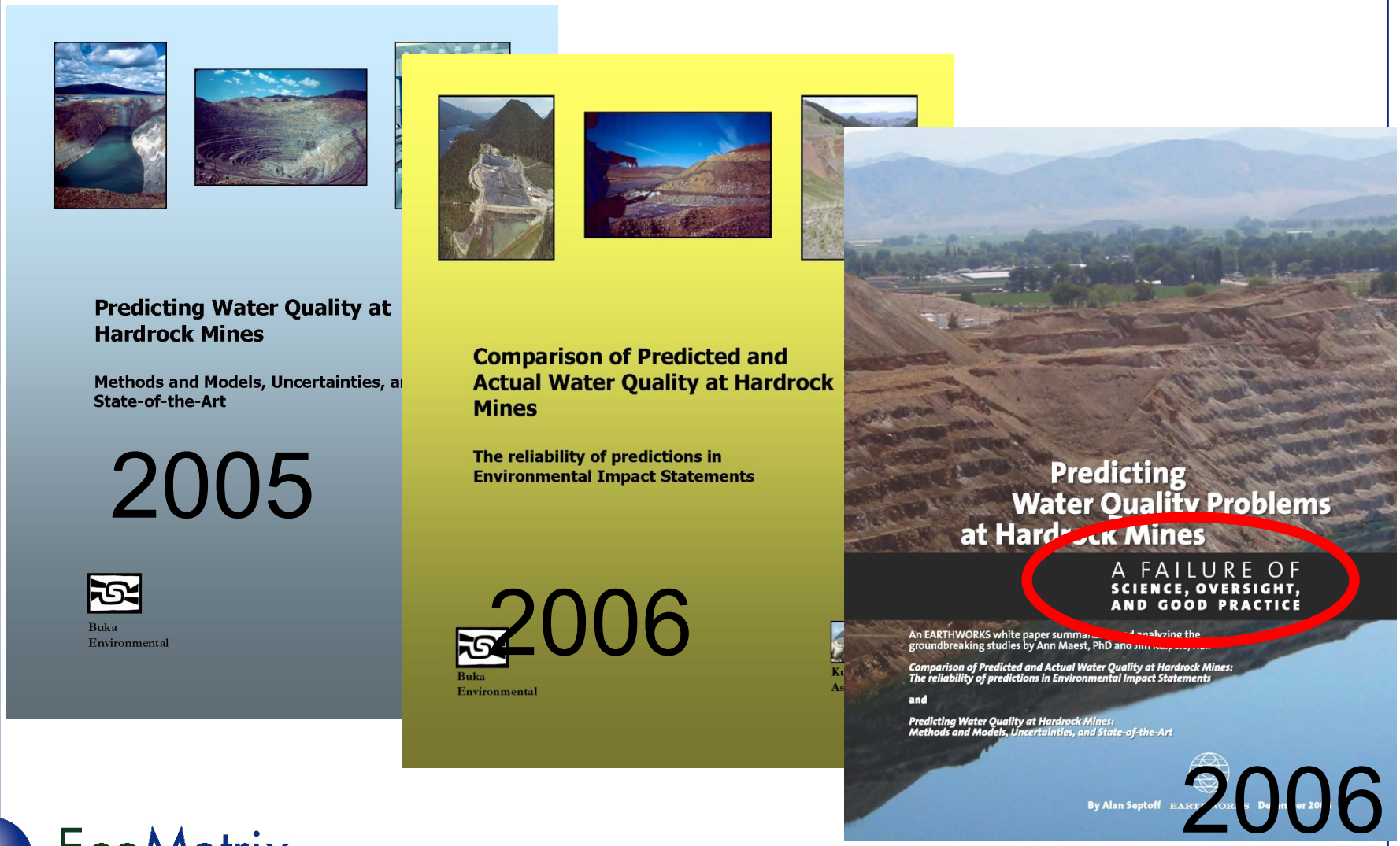
Maest, Kuipers, MacHardy and Lawson

Prediction Success / Failure



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Maest, Kuipers, Travers, Atkins, MacHardy and Lawson

Causes of Failures

- Two Principal Modes

1. a. Poor Hydrology
   b. Poor Geochemistry

2. Mitigation
   - Not Identified
   - Inadequate
   - Not Implemented

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But Ron….

surely we have learned something to get it right in the 35 years since you started your PhD????

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Challenges?

- TIME
  - Weathering is a time dependent process
  - There is no substitute for time
  - Studies require time

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Challenges?

- Geochemistry is Messy – it's not rocket science (that's easy)

- Not all reactions are ideal
    - Not like those studied in Chem 001

- Kinetic testing is complex with many influencing variables

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Challenges? - from Andy Robertson 2011

2011 MINE CLOSURE CONFERENCE

TOP 10 THINGS THAT GO WRONG WITH PLANS FOR MINE CLOSURE

Men do not plan to fail – but fail to plan adequately

Common Reasons:

1. Planning for the incorrect **objectives**
2. Planning with flawed **science**
3. Plan for an event, when closure is a **process**
4. Plan with inadequate **financial provisions**
5. **Murphy** and **Black Swans** are on the 'other team'

6th INTERNATIONAL CONFERENCE ON MINE CLOSURE | SEPTEMBER 18 - 21, 2011 | LAKE LOUISE, ALBERTA, CANADA

Incremental Geochemical Failures are not that different in Costs than Catastrophic Geotechnical Failures

Consider Faro

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Complex Sources

Tailings

Waste Rock

Ore Stockpiles

Mine site

Pits

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When You Get the Basics Wrong….

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And if we get the acid thing right….Some Additional Challenging Issues

- Metal Leaching at Neutral pH
- Arsenic
- Selenium
- Sulphate

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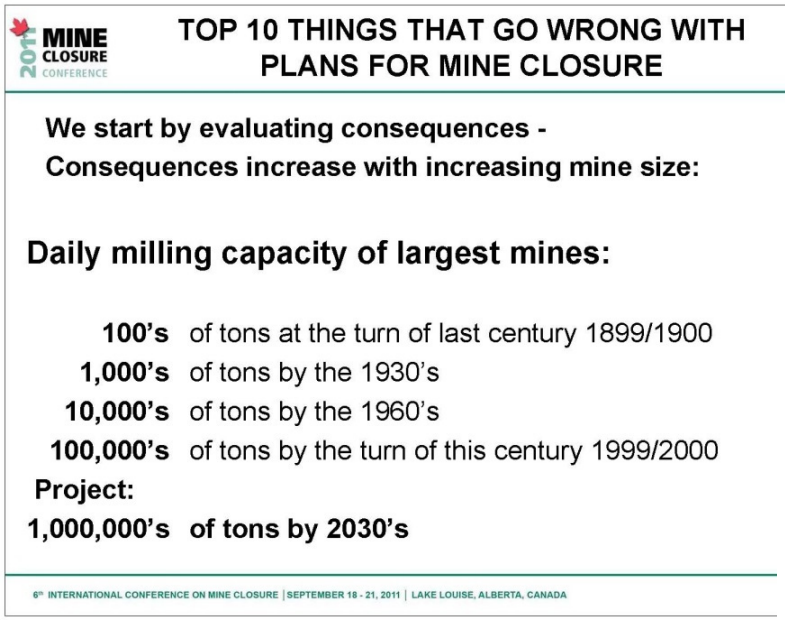
Increasing Quantities Of Mine Materials - from Andy Robertson



Large Masses of Rock can Release Large Loadings

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Solutions? - Technical

- Field-scale long-term studies with new projects
- Retrospective field studies at older operating and closed sites
- Follow-up Programs (Validation)
- Contingencies (financially supported)

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Solutions? - Risk Management

- Peer Review
- Review Boards

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Tools and Research Needs?

- Fragmentation controls for waste rock (weathering and loading rates are a function of particle size)
- Practical Co-disposal methods (limiting waste rock exposure – shifting control to surface processes

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What Uncertainties?

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What Uncertainties?

- Scale-up?
- Solubility Chemistry?
- Loadings?
- Particle Size Effects?
- Natural attenuation?

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Dealing with Uncertainties

- Conservative assumptions to bound uncertainties

- But not so conservative as to do prevent any activity

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New Tools and Research?

- Magic Bullets??
- Machine to put all mined materials back in the ground – at low cost (for John Stroiazzo)
- Evolution of Canadian lakes used for sustainable mine waste management
  - can we get social approval for a proven technology?

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Get out of your comfort zone and join the discussion

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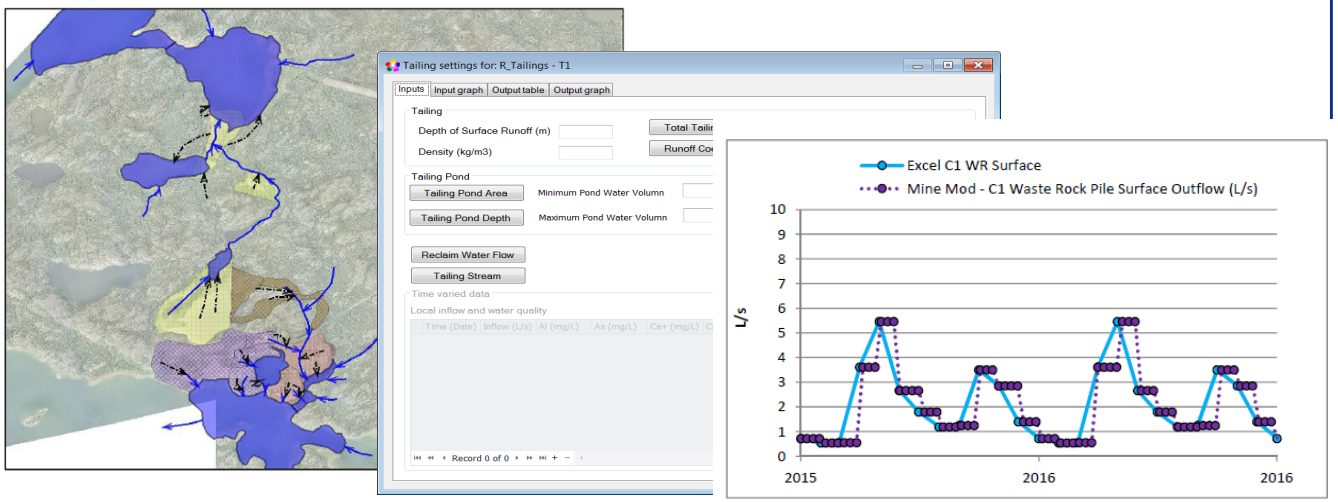
Thank you for you attention!

Questions?



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Planning

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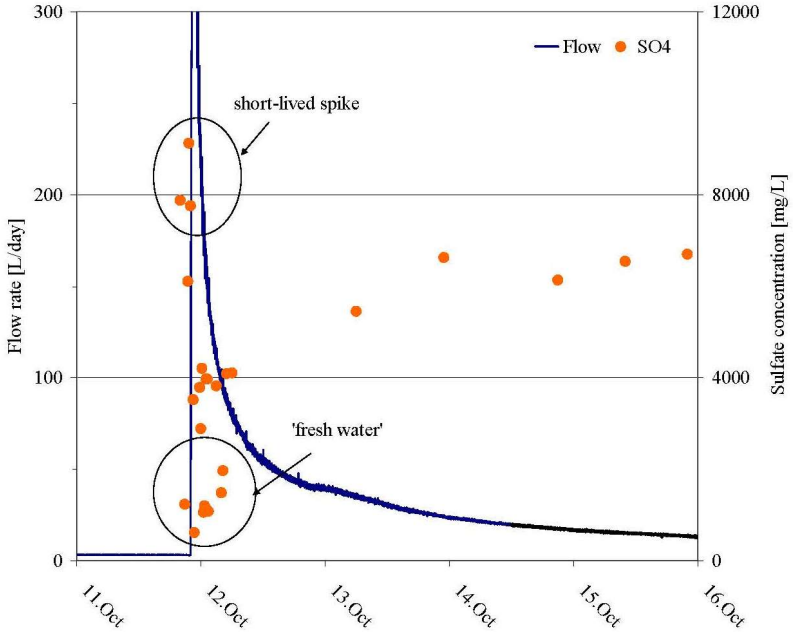

Figure 5. Sulfate concentrations and flow ra
October 2001.

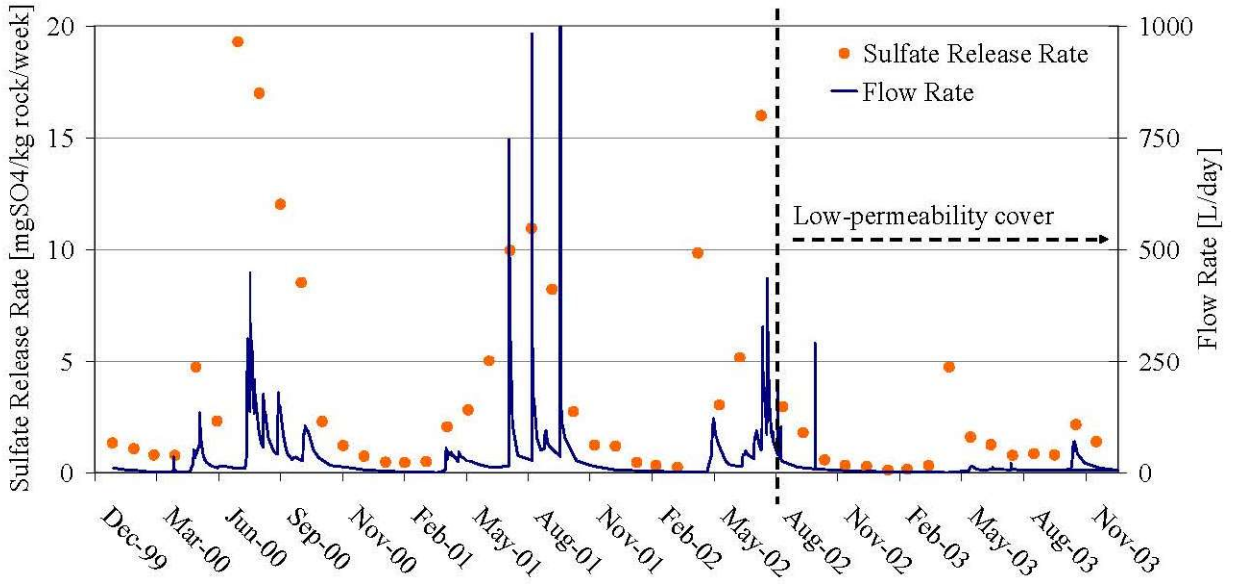

Figure 6. Monthly sulfate release rates and flow rates measured at the base of the pile between December 1999 and December 2003.

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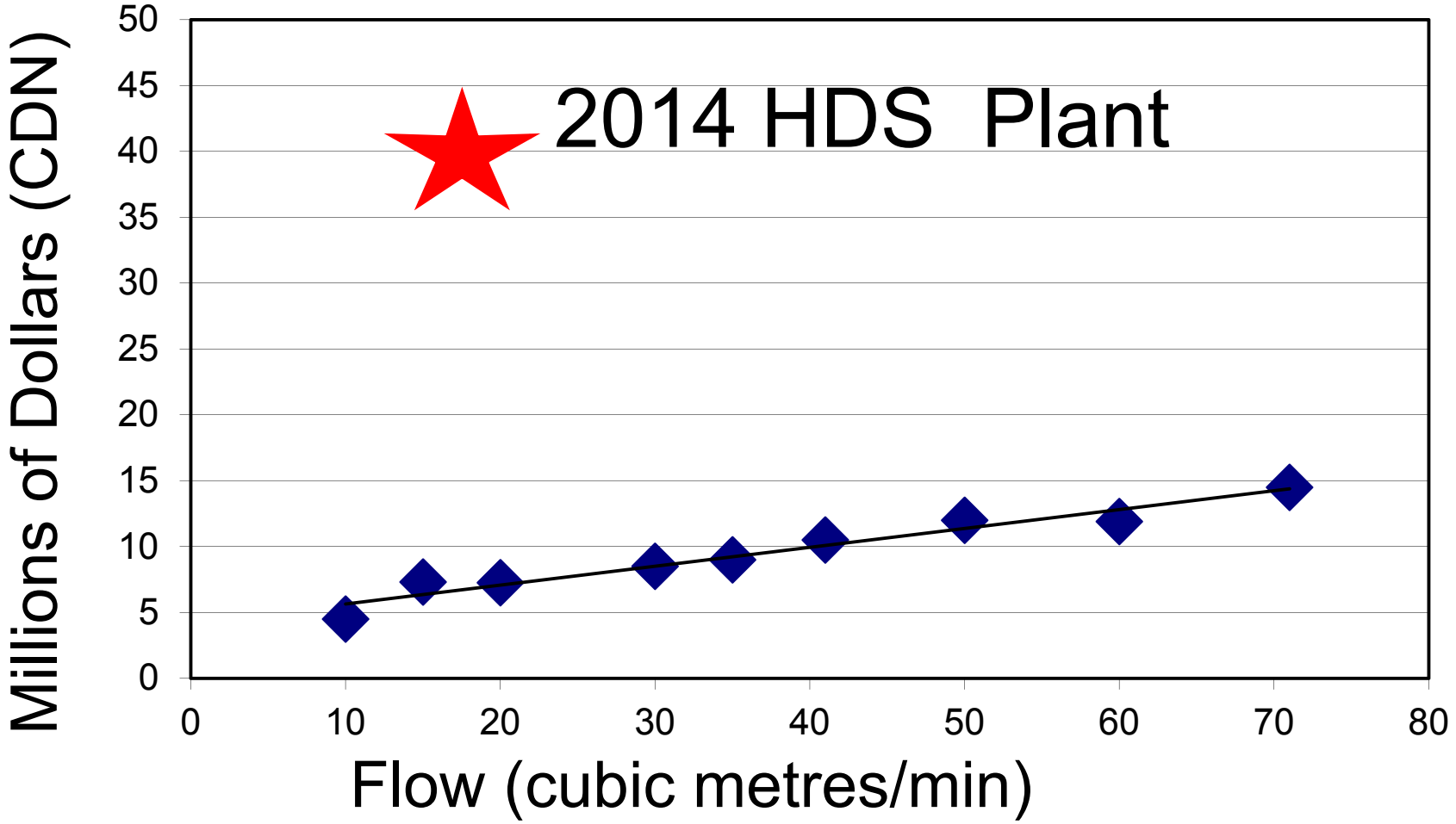
CAPEX for HDS Lime Treatment System - 2001 CDN Dollars



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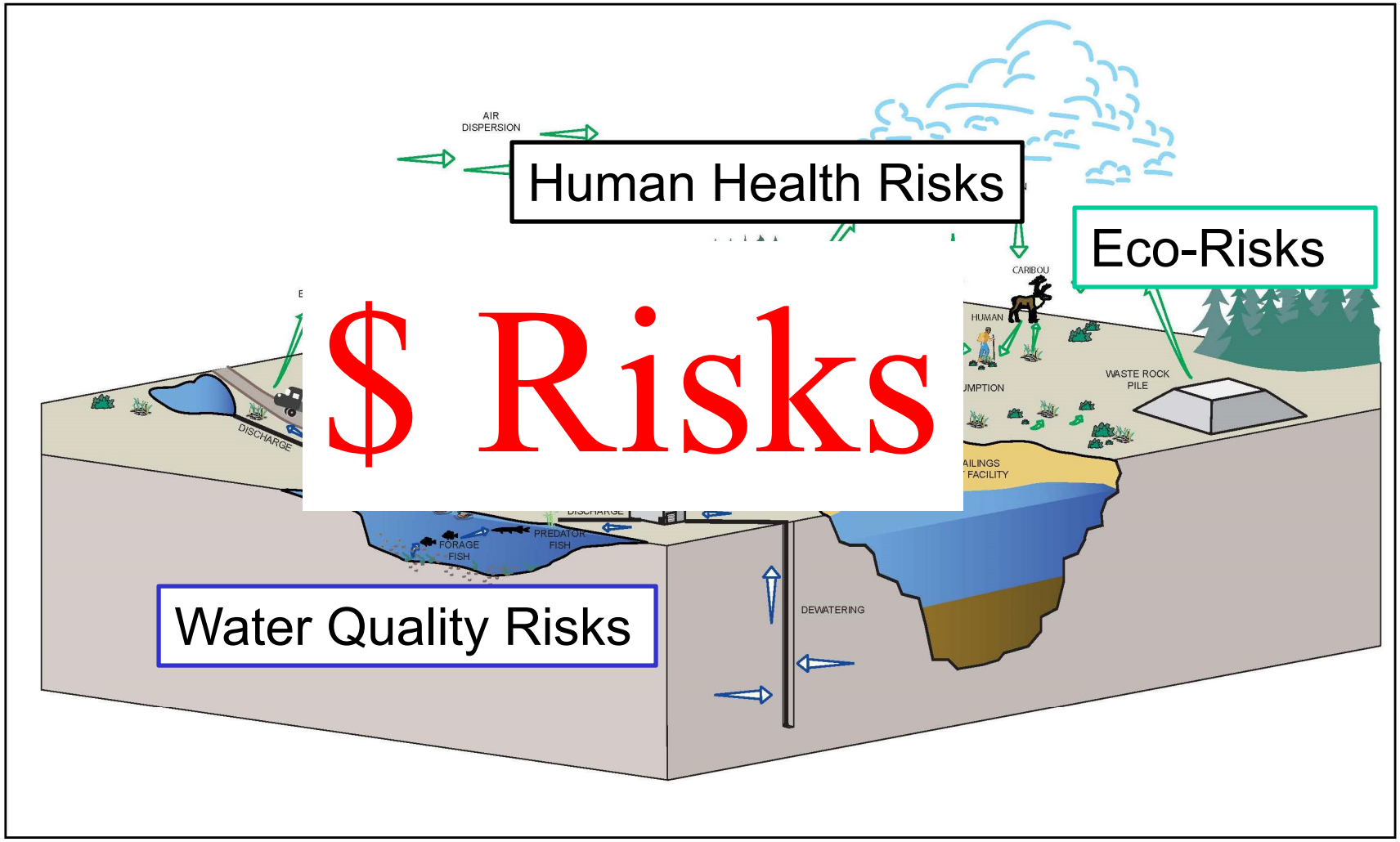
What are the Risks?



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Faro

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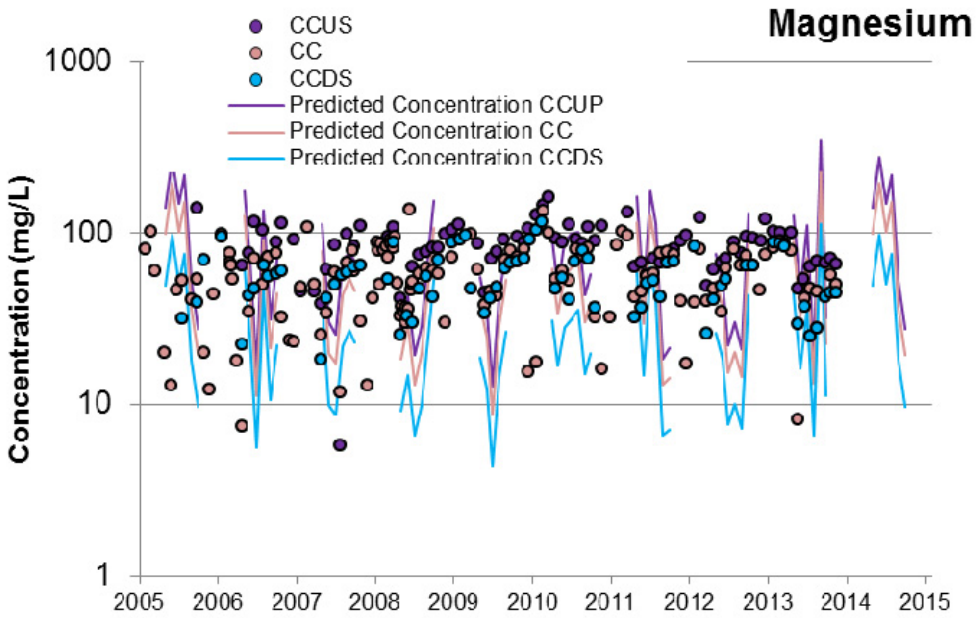
Basecase Scenario - CCUS



- Seasonality within the SW monitoring locations was unable to be captured due to the frozen months which had zero flow

- Annual average flow values were used to validate the model predictions and remove this uncertainty

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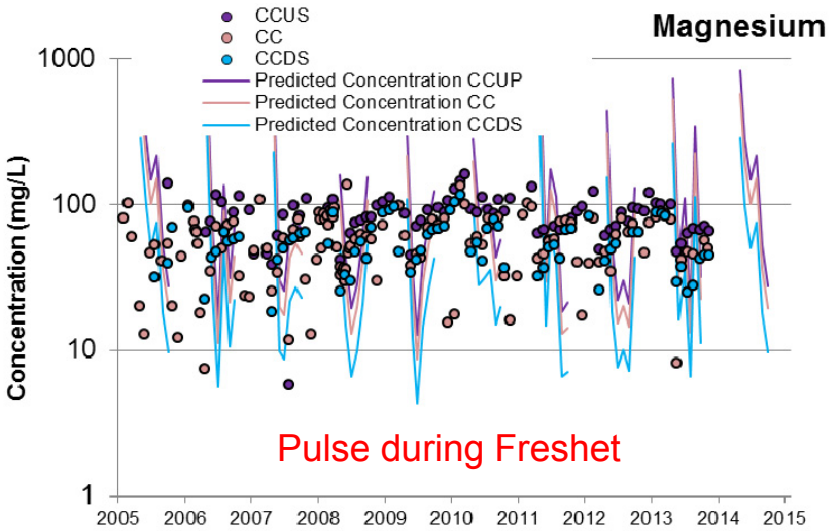
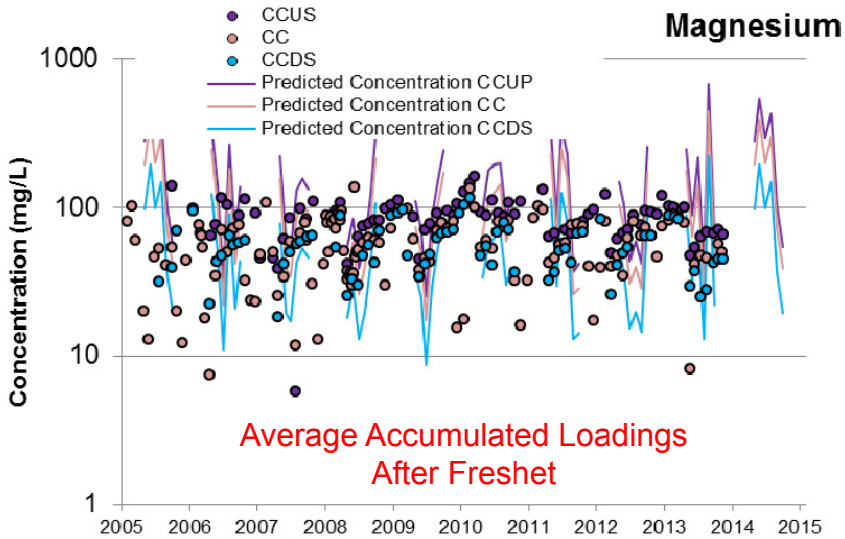
Basecase Scenario - CCUS





- Behaviour of loadings reporting to CCUS from the WWRP during the winter months investigated
- Two scenarios developed:
  - Storage of winter loadings, release during freshet (pulse)
  - Storage of winter loadings, average release over 6 months

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Get c
your c
zone
join
discu

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