CERM3's Millennium Plug Project at the Britannia Mine

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The Centre for Environmental Research in Minerals, Metals and Materials

CERM3

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cerm3

Centre for Environmental Research in Minerals, Metals and Materials

Providing
Sustainable Research
for the Mining Industry

Reach for the Stars Celebrate UBC Research

CERM3 Home

Introduction to CERM3

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CERM3 News

Contact Information

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UBC

This site is under construction;
thank you for your patience.

Created by Jeff Breadner and Robert Chu

http://www.cerm3.mining.ubc.ca

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CERM3 Mission Statement

- to foster high regard for sustainable mining practices and concern for the environment
- to develop innovative methods to ensure the future sustainability of the Mining Industry
- to train the next generation of Mining and Processing Engineers for the 21st Century
- to improve the image of Mining in society

Research Participants

10 departments are represented
- Westwater Research Centre
- Chemical and Biological Engineering
- Chemistry
- Civil Engineering
- Earth and Ocean Sciences
- Electrical Engineering
- Metals and Materials Engineering
- Microbiology
- Mining and Mineral Process Engineering
- Occupational Hygiene/Epidemiology

4 Companies (Inco, Syncrude, Nautilus, Rescan)

34 Research Faculty in total

CERM3 Facilities

Environmental Quality Lab

- analytical support and research into assay protocols.

Bioremediation and Reclamation Lab

- biological solutions for environmental problems.

Environmental Technology Lab

- new processes to reduce energy, material use and pollution.

Mine Health and Safety Lab

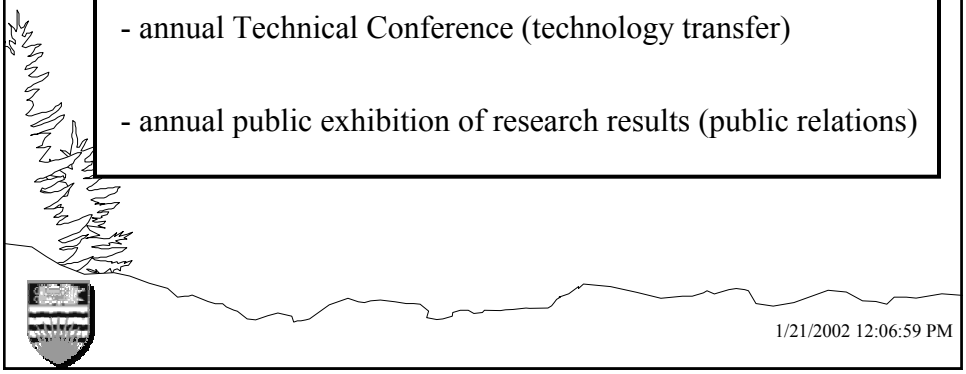
- improvements in the working environment.

Mine Automation/Environmental Simulation Lab

- integration of mining and processing; remote-mining.

Annual Activities of CERM3

- monthly research activity meetings (feedback/revision)
- annual review meeting of the TAC (priority setting)
- annual Technical Conference (technology transfer)
- annual public exhibition of research results (public relations)



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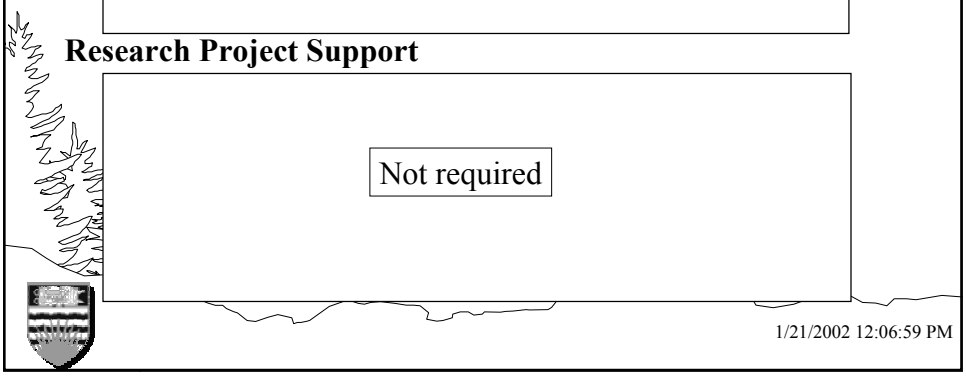
CERM3 Membership - **BRONZE**

General Fees

$250 per year

Research Project Support

Not required



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Corporate Membership - **SILVER**

Operating Infrastructure Support

$1,000 per year

Research Project Support per company for 5 years

$ 5,000 per year cash support

$ 5,000 per year in-kind support

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Corporate Membership - **GOLD**

Operating Infrastructure Support

$2,000 per year

Research Project Support per company for 5 years

$ 5,000 per year cash support
$ 5,000 per year cash support for specific projects

$ 10,000 per year in-kind support

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Corporate Membership - **GREEN**

Operating Infrastructure Support per company

$5,000 per year

Research Project Support per company for 5 years

$ 10,000 per year cash support
$ 10,000 per year cash support for specific projects

$ 20,000 per year in-kind support

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CERM3 Corporate Membership Benefits

- access to top-quality research into environmental problems of significance to your company
- participation in the direction of **CERM3**'s research
- participation in the annual meeting of the **TAC**
- ability to second employee(s) to work at **CERM3** with office space/UBC campus access
- ability to "buy-in" to intellectual property rights to the outcome of research conducted at **CERM3**

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Intellectual Property Rights Policy

- UBC has an excellent and active Industrial-Liaison Office
- all research conducted at UBC is in the public-domain
- all intellectual property derived from **CERM3** research will be retained by the University of British Columbia
- **CERM3** Corporate Members will be given a **Royalty-free limited license** to use such property
- licence terms will be negotiated on an individual project and/or corporate basis by UBC-ILO
- purchasing of the property rights can be arranged through negotiations with UBC-ILO

Collaboration with CERM3

- The research provides new approaches for industrial applications
- Funding is essentially multiplied between 2.5 to 4 times
- The companies with positive outlooks on sustainability that we expect to become Corporate Members of **CERM3** include:

- Anglo Am.	- Falconbridge	- Noranda	- Shell
- Barrick	- Fording Coal	- Outokumpu	- Sherritt
- BHP-Billiton	- Hatch	- **Placer Dome**	- Suncor
- Boliden	- **Homestake**	- Phelps-Dodge	- Svedala
- Cominco	- **Inco**	- Rio Algom	- **Syncrude**
- Newmont	- Luscar	- Rio Tinto	- Teck Corp.

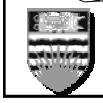
- PRECARN, **CanMet** and **BC Ministry of Mines** will also be involved in the Technical Advisory Committee

The Millennium Plug

- Built in much the same way as an earth dam
- Impervious clay core
- Layers of sand, gravel, rabble
- Resistant to acidic conditions
- Cheaper to build
- Improved resistance to seismic events
- Uses locally available materials
- Generates a “walk-away” solution

UBC - Britannia Mine Collaboration

- for over 26 years, > 9000 tonnes of heavy metals have spewed into Howe Sound with no one assuming responsibility to correct the problem
- UBC has need for a research facility to conduct testwork into the design of bulkheads to seal tunnels
- by placing this laboratory at the 2200 level portal of Britannia Mine, two synergistic events occur:
  - UBC installs its research lab at a full-scale field site
  - Britannia Mine closure plan moves nearer to fulfillment



Howe Sound from above Britannia Beach

A place of mystery…..

…..in more ways than one!

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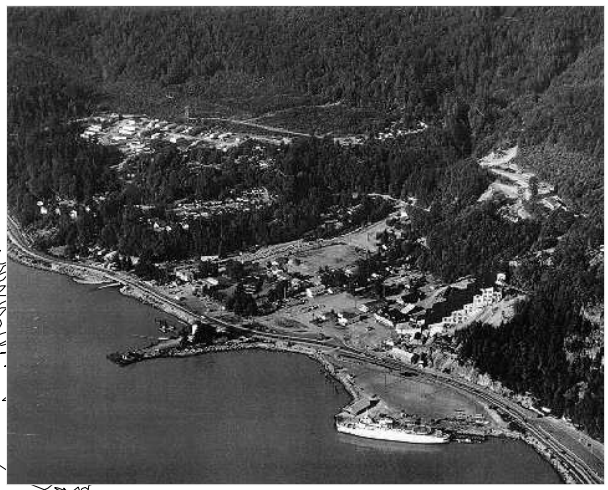
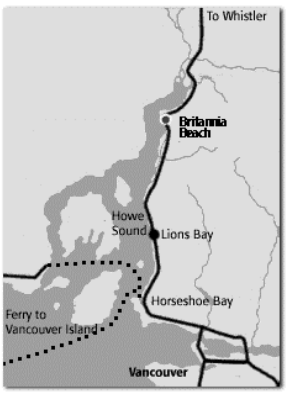
Location of Britannia Mine





Britannia Beach, B.C.

Looking towards Squamish

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Contaminant Plume from Britannia Creek

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Problems at Britannia

Technical

- ARD from mine portals impacts Britannia Creek and Howe Sound
  - total flowrate averages ~500 m^3/hr.
- ARD from open pits and waste dumps enters the mine workings
- Reclamation of open pits and waste dumps is necessary

Political/Financial

- Copper Beach Estates Ltd. has been in default since 1991
- Previous owners are not taking responsibility for the site
- Government has issued numerous clean-up orders since 1981
- meeting of Potentially Responsible Parties on Nov. 30, 2000

Potentially Responsible Parties

Alcoa	Canzinco
Alumax Inc.	Copper Beach Estates Ltd.
Anaconda/Arco	Howmet Holdings Corporation
Arrowhead/Ivaco	Intalco Aluminum Corporation
Province of British Columbia	Government of Canada

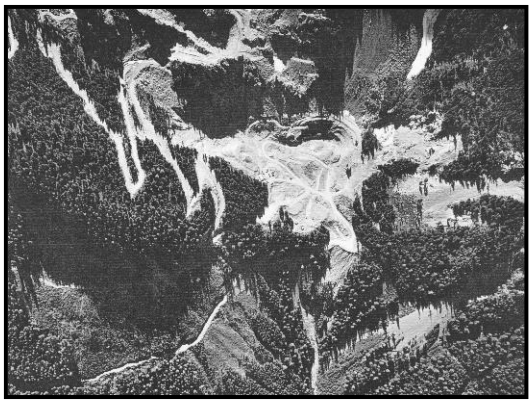
Terms of the PRP Agreement:

- Total indemnity for the non-owner PRPs
- C$ 15 million in 2001 and 2002 = a total of $30 million
- C$ 9.5 million from Federal-Provincial Reclamation Fund
- C$? million from Copper Beach Estates

Effluent Quantities and Contaminant Levels

Item	4100 Level	2200 Level
Flowrate (m^3/hr)	9600	2400
pH	3.5-4.4	2.7-3.0
Cu content (mg/L)	12-22	30-100
Zn content (mg/L)	25-30	28-35
Total Tonnes of Cu & Zn per year	~ 300	

Fairview Pit from the Air



Jane Pit Waste Dump and Open Adit (glory hole)

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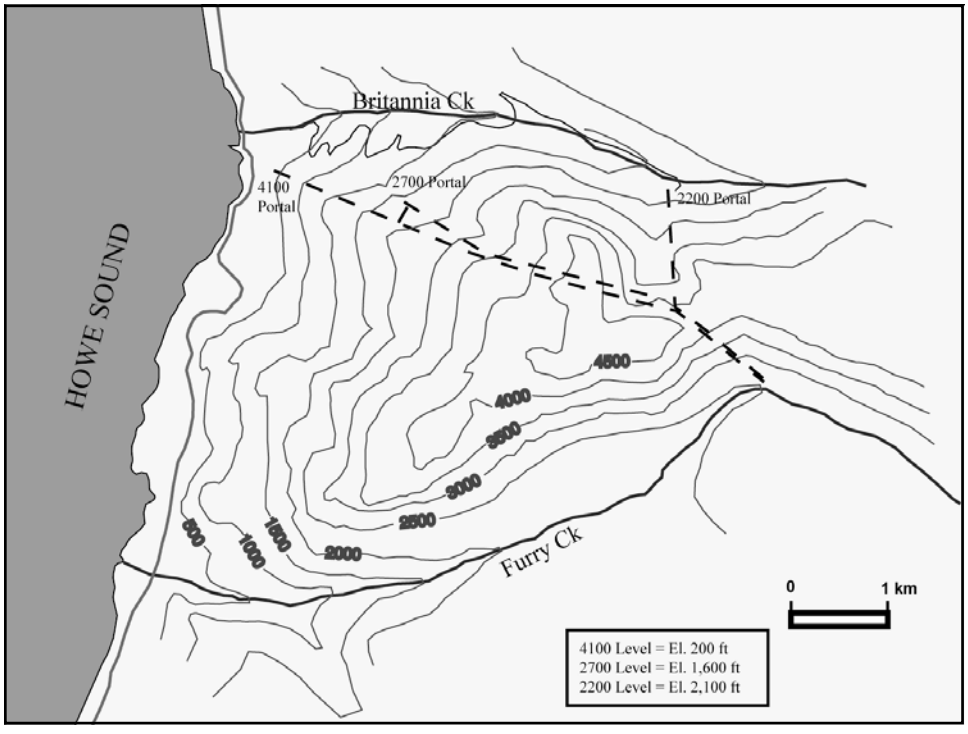


Expected Permit Levels for the Treatment Plant

pH		6.5 - 9.5
96HRLC50 Fish bioassay		100%
LT50 Fish bioassay @100% conc.		96 hours
Total suspended solids		25 mg/L
Element	Dissolved (mg/L)	Total (mg/L)
Al	0.20	0.50
Cd	0.01	0.05
Cu	0.05	0.20
Fe	0.01	0.50
Pb	0.05	0.20
Mn	0.20	1.00
Ni	0.20	0.50
Zn	0.15	0.30

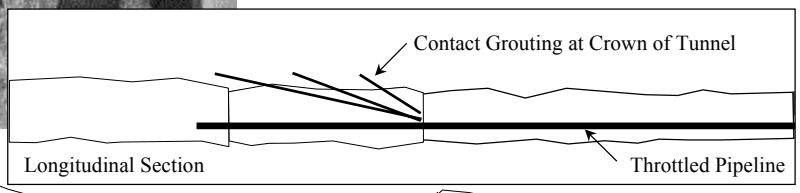
* based on 1999 permit issued to CBEL

4100 Level Discharge Pipeline

Existing Tunnel Plug

- located in the 4100 level adit

- required to throttle and control flow to a future treatment plant



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Details of our Agreement with CBEL

- Hand-shake agreement in October 2000
- Negotiations over the past year focused on
  - ✓ Indemnity agreement for UBC provided by CBEL
  - ✓ CBEL assuming ownership of the plug
  - ✓ Shared costs (96,400 from UBC/$73,500 from CBEL)
  - ✓ Leasing arrangement for 5-year duration
- CBEL was purchased by Alex Tsakumis in July
- UBC demanded an indemnity from the BC Government
- TSS contracted by CBEL to build the two plugs
- CBEL obtained a permit from MEM in August, 2001
- Construction commenced October 5th, 2001

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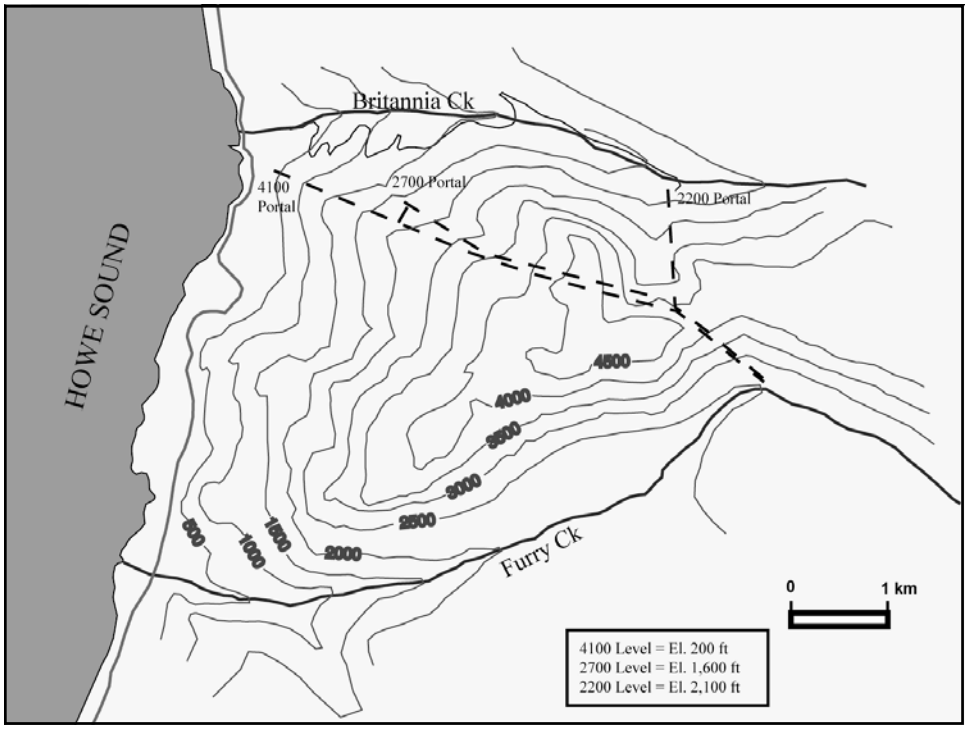

Jane Creek after confluence with 2200 Level Discharge

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Corrosion and Failure of Steel Sets in 2100 Adit

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Corrosion of Concrete by ARD at Britannia Mine

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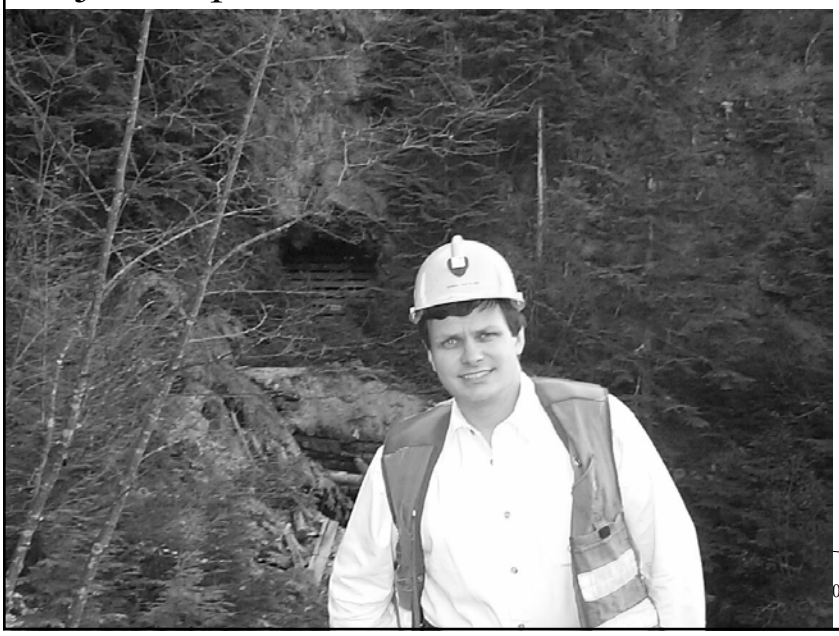
Project Supervisor - Rimas Pakalnis



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Doctoral Candidate - Brennan Lang

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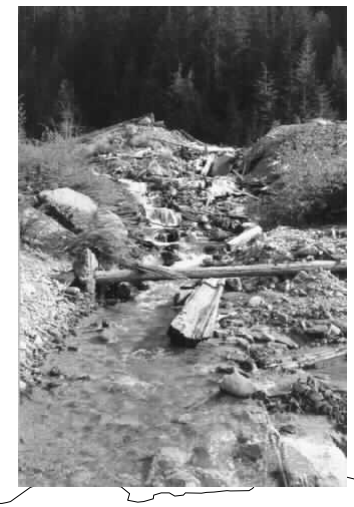
Effluent Channel before Jane Creek



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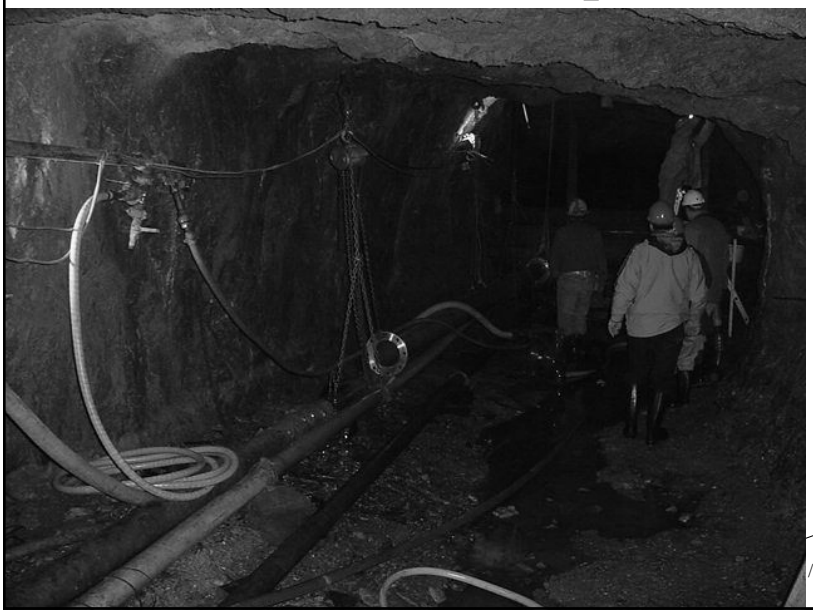
Effluent leaving the 2200 level Portal

Effluent Channel circa 1990

Inside the 2200 level portal



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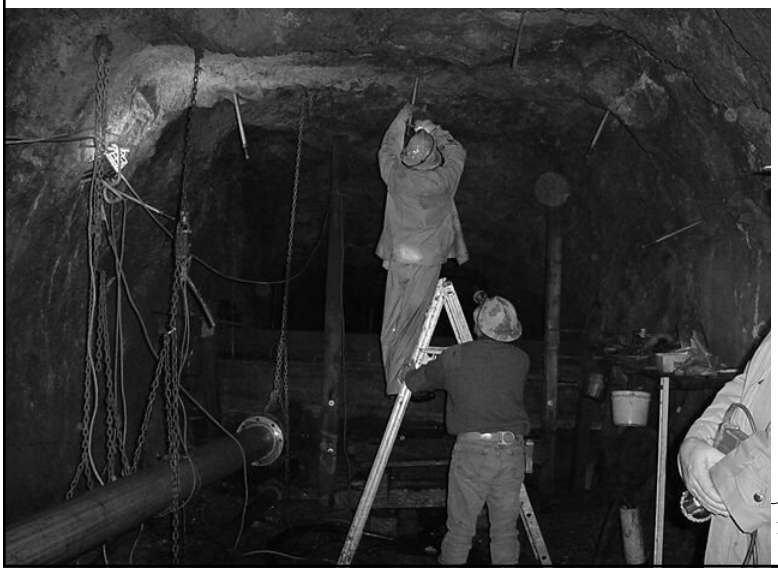
Installing Grout Tubes



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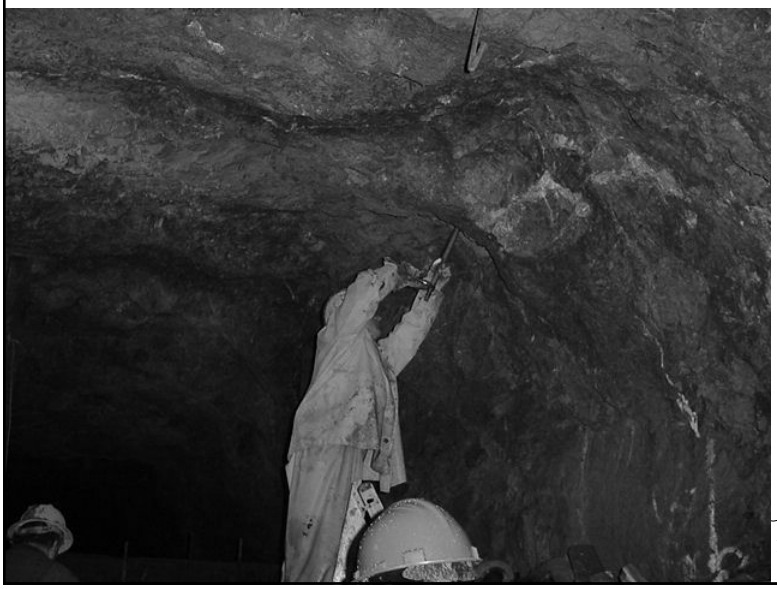

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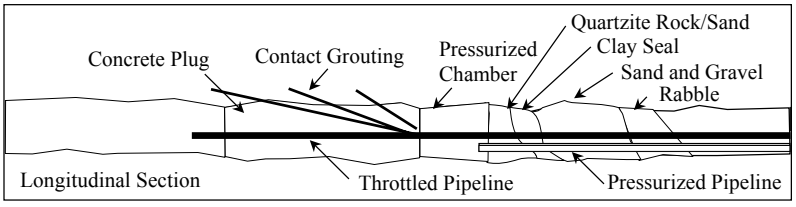
Installation of the UBC Soil-Testing Laboratory in the 2200 Level Portal at Britannia Mine



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Construction Schedule

Oct 5th – Project Began

Nov. 5th – Water flow under control

Nov. 15th – Coffer Dam installed, grout holes drilled

Dec 5th – Concrete Plug poured – actual date = Dec 17th

Jan 3rd – Effluent flow stopped – actual date = Dec 31st

Feb 3rd – Commencement of Millennium Plug construction

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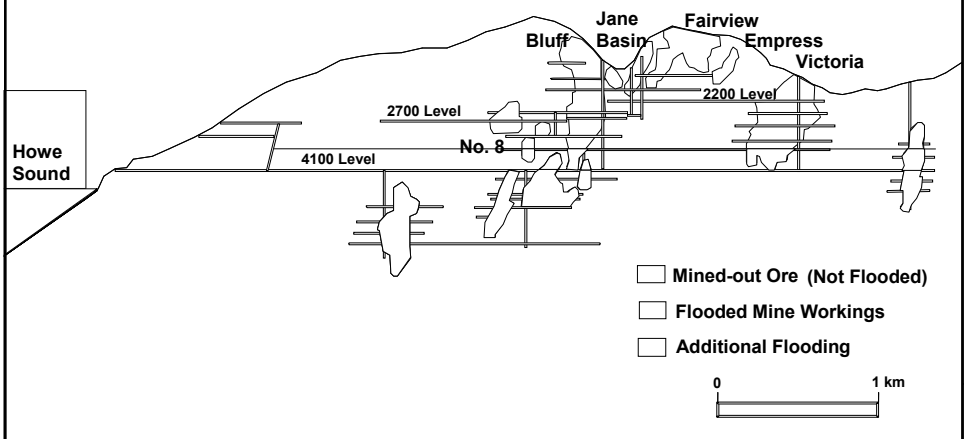
Britannia Mine



Ministry of Water, Land & Air Protection Reclamation Project

-3 RFPs have been let so far
- Hydrology and hydrogeology
- Contaminated Sites analysis
- Water treatment plant

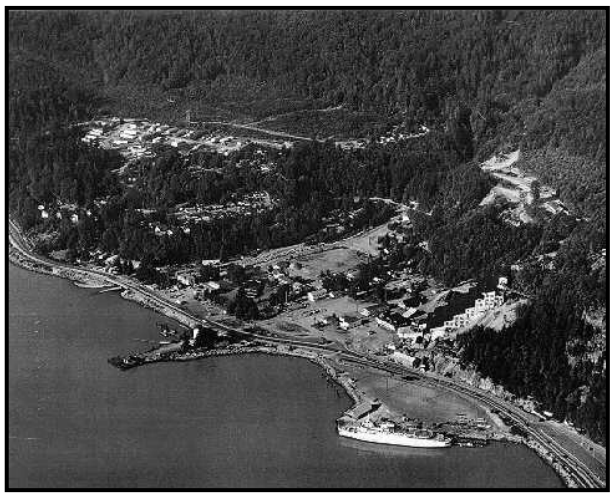
- 4100 Level Plug test to be done in mid-December

- Tracer studies of water flows from the Open Pits in December and January

- CERM3/CBEL are working in cooperation with the contractors

- Treatment plant is planned for start-up in 2003

Working with the Community for Sustainability



Britannia Beach Mining Museum

- opportunities for collaboration with CERM3

The mill is the largest heritage building in British Columbia

But what to do with it –
- a very difficult question!!

One idea – create an amphitheatre for concerts and plays

Imagine – the Annual Britannia Beach Oberammer-gau

Wagner on the Sound !

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Britannia Beach Mining Museum

- opportunities for collaboration with CERM3

CERM3 Britannia Beach Research Field Station

CERM3 is assisting the Mining Museum to develop ARD exhibits in exchange for space for a research a research station

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Elements of the Reclamation Efforts Required

- 2200 level effluent diversion
- Pit waters diversion (where to , if possible?)
- Treatment plant at 4100 level
- Ground water recovery and treatment
- Sealing dumps and pit walls
- Diversion ditches
- Revegetation of all dumps
- Development plans for the community
- Reclamation around museum property
- Introducing fish into Britannia Creek
- Flood control in the fan area
- Plans for the mill building

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CERM3 Projects

Project 7:
Immobilizing Heavy Metals in Lime Sludge by Developing Acid-Resistant Ceramic Materials for Long-Term Storage

Researchers: John Meech, George Oprea, Bern Klein
Tom Troczynski, Bill Cullen, N. Banthia

Sponsors: NSERC, Tilbury Cement, C2C Mining, Clayburn Industries, Target Products, Hatch Engineering, Levelton Engineering, Cominco, Copper Beach Estates Limited

Estimated Budget: $425,000 over 3 years

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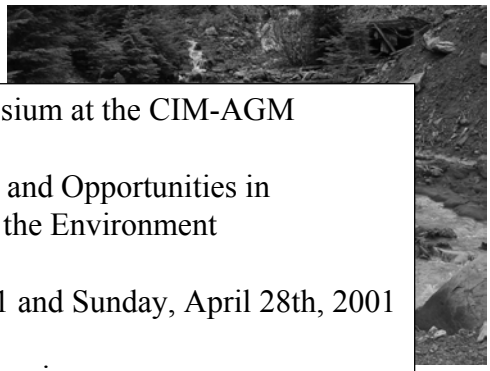

Workshop Symposium at the CIM-AGM

Research Needs and Opportunities in Mining and the Environment

Saturday, April 27th, 2001 and Sunday, April 28th, 2001

Organizers:

John A. Meech, Professor and Director, CERM3

Gilles Tremblay, MEND-2000 Program, NRCan

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Red

Orange

ARD comes in many colours – let's work to make it colourless

Yellow-green

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- providing sustainable research for the Mining industry…..

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