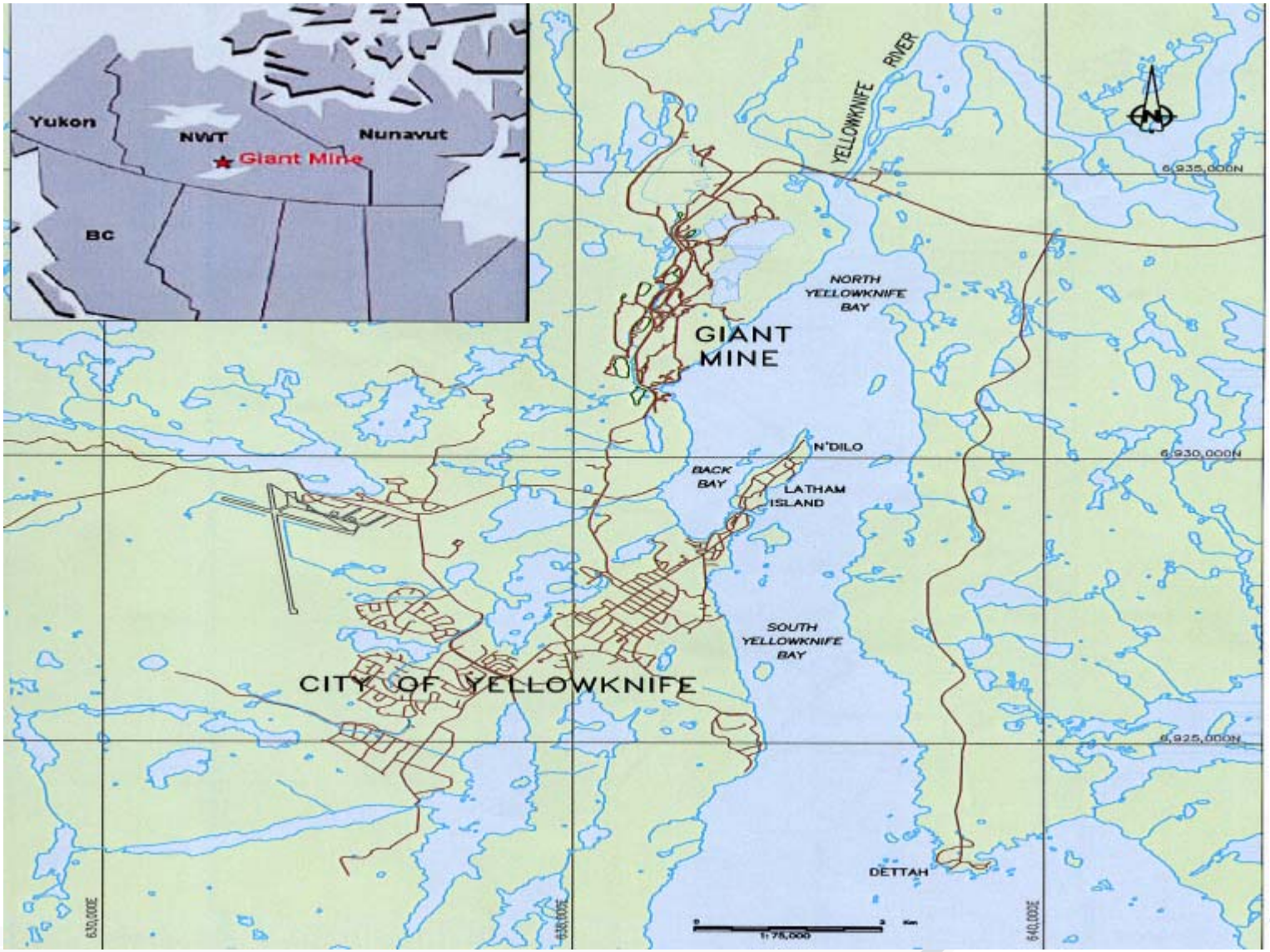
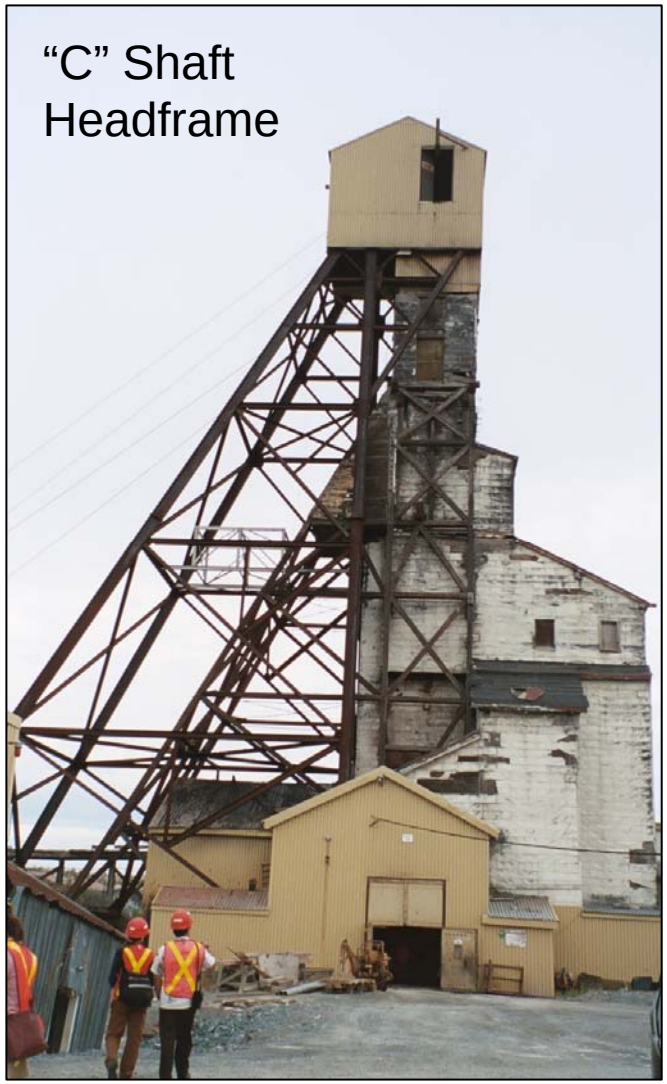
Giant Mine Remediation Project

RemTech,

Banff, AB Oct 2009


Yukon
NWT
Nunavut
Giant Mine
BC
YELLOWKNIFE RIVER
NORTH YELLOWKNIFE BAY
GIANT MINE
N'DILO
BACK BAY
LATHAM ISLAND
SOUTH YELLOWKNIFE BAY
CITY OF YELLOWKNIFE
DETTAH
6,935,000N
6,930,000N
6,925,000N
630,000E
635,000E
640,000E
1: 75,000

- **Giant Mine History**
  - Several companies owned and operated Giant Mine for 55 years. 1948 - 2004
  - 7.6 million ounces gold were produced by roasting arsenopyrite
  - Ultimately, bankruptcy of the last two mine operators left Indian and Northern Affairs Canada (INAC) and the Government of the Northwest Territories (GNWT) responsible for the site.
  - The former mine lease area is now a reserve issued to INAC by the GNWT.
  - The site is currently under the care and maintenance of INAC/PWGSC



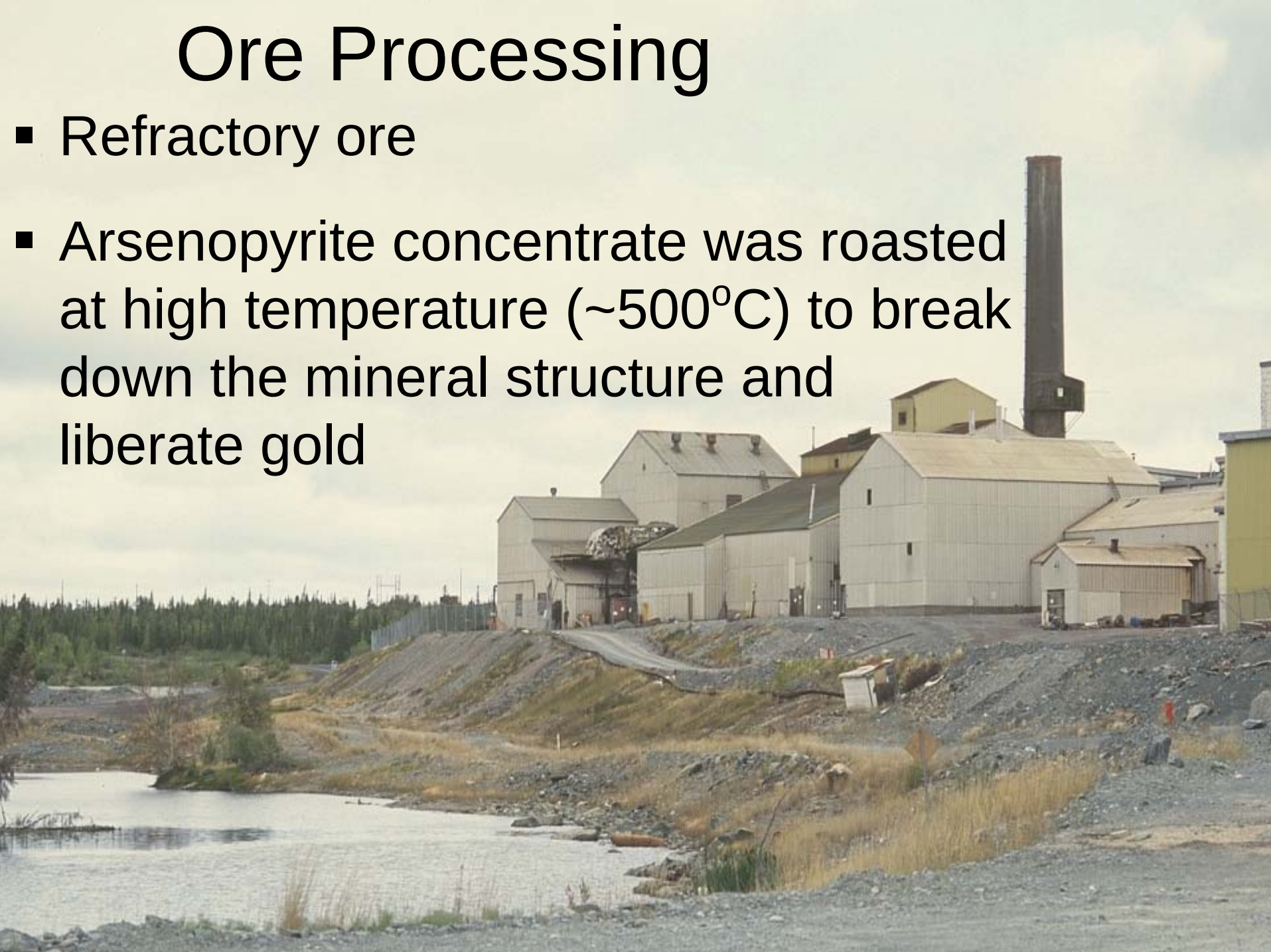
- **Legacy of mining activity**
  - Contaminated surficial materials (arsenic and hydrocarbon)
  - Buildings with severe arsenic contamination, asbestos insulation
  - Decaying mine infrastructure
  - Tailings impoundments, sludge settling and polishing ponds
  - Toxic arsenic trioxide dust in underground storage (237,000 tonnes)


Giant Mine

- NWT Commissioner's Land
- Within Yellowknife City Limits
- Includes Town Site

Ore Processing

- Refractory ore
- Arsenopyrite concentrate was roasted at high temperature (~500^{o}C) to break down the mineral structure and liberate gold



Gold Extraction by Roasting

Arsenopyrite Fe^{3+} As S

As 46.01%

Fe 34.3%

S 19.96%

As_2O_3

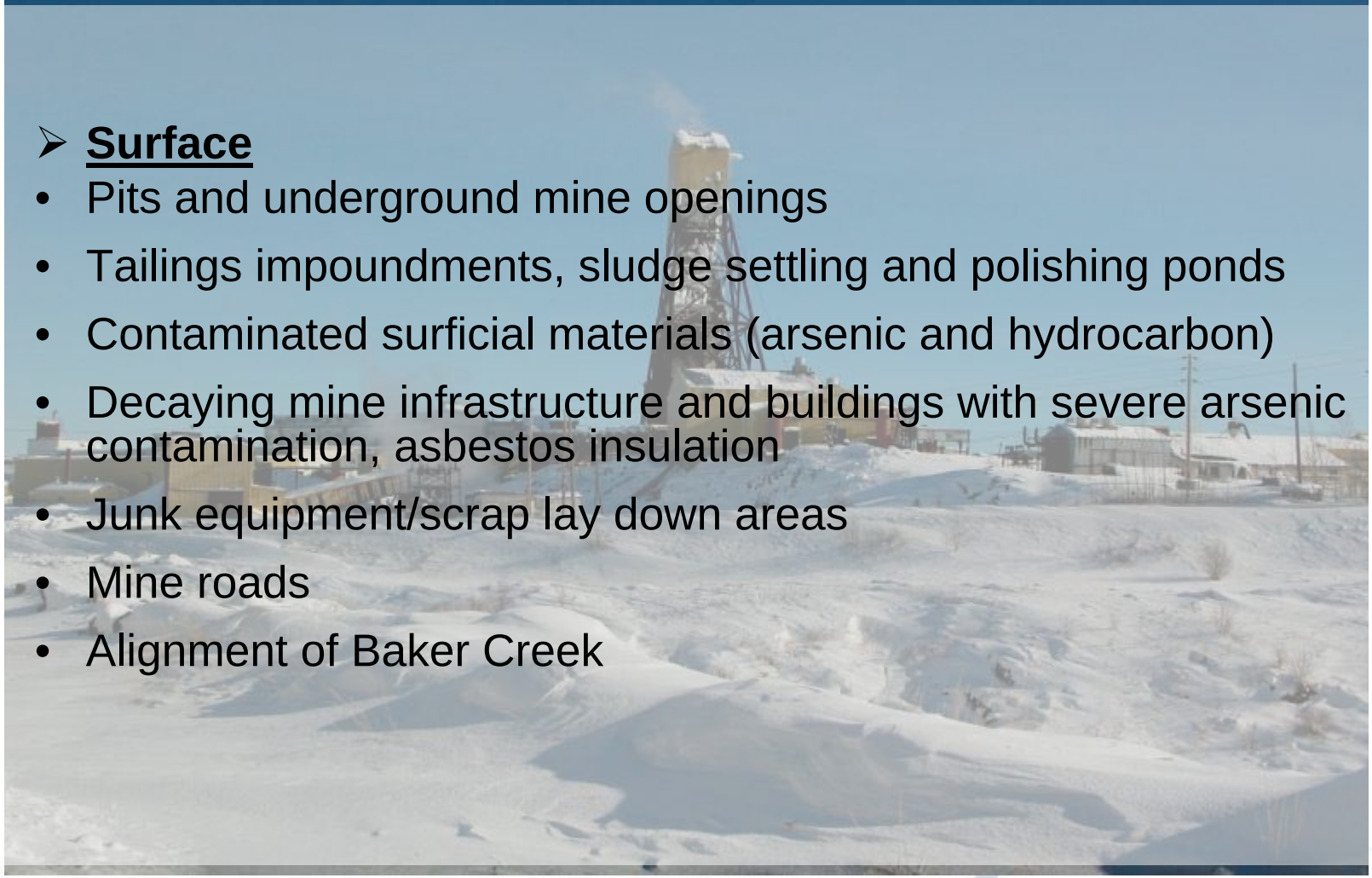
Common Impurities
Au, Ag, Co, Sn, Ni, Sb, B, Cu, Pb

- **Roasting process to extract gold produced 237,000 tonnes of arsenic dust as byproduct – now in underground storage**

Remediation Plan Review

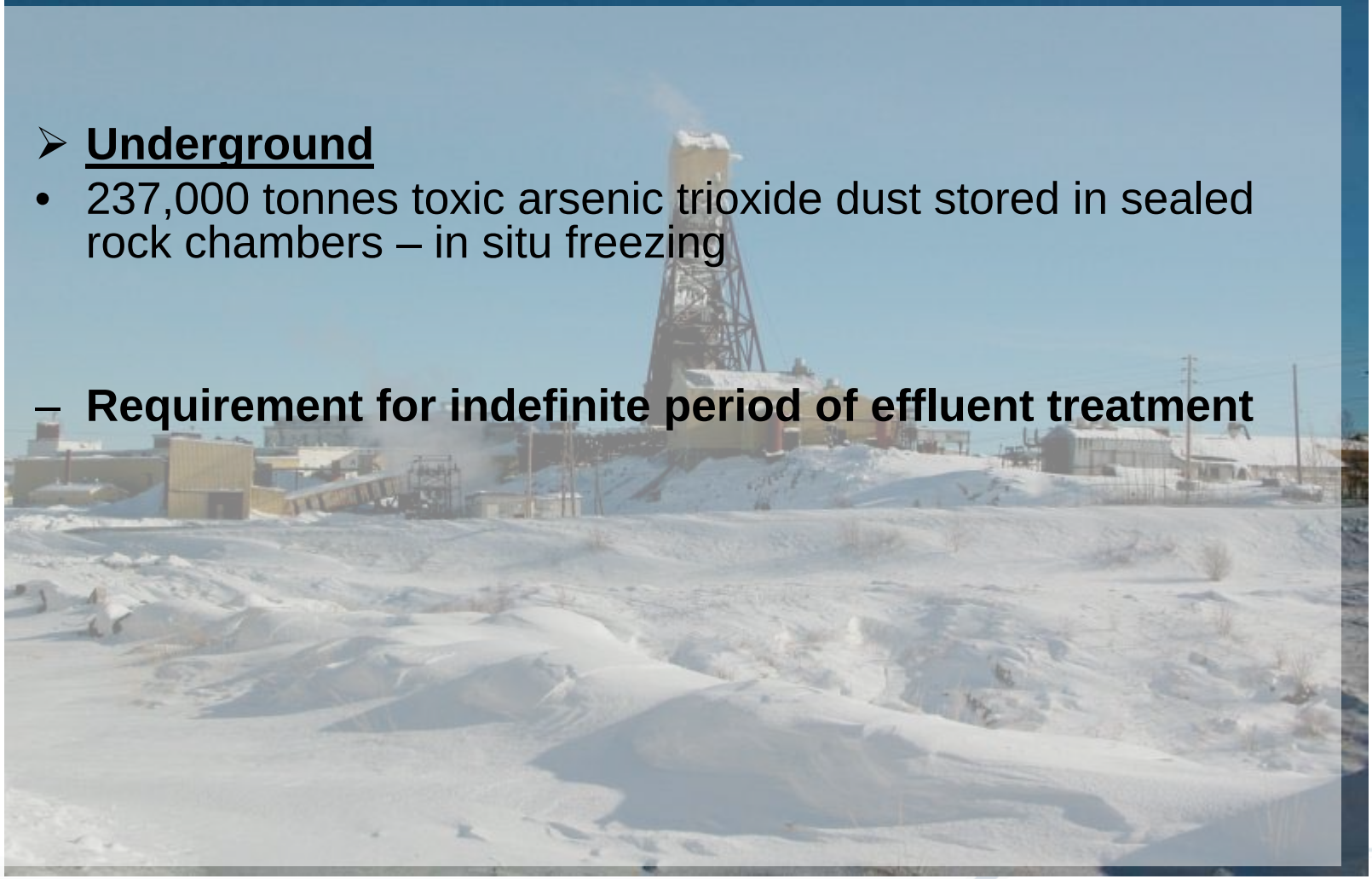
- Review and ongoing involvement by expert federal departments
  - Environment Canada
  - Fisheries
  - Health Canada
- Peer Review
- The remediation project is currently undergoing an Environmental Assessment
  - The scope and terms of reference have been established by the Mackenzie Valley Environmental Impact Review Board (MVEIRB).
  - The Developer's Assessment Report (DAR) is currently under development by INAC/PWGSC.
  - A decision on the project's environmental effects by the MVEIRB is required before a water licence for treatment plant discharge can be granted by the Mackenzie Land and Water Board.

Remediation Plan Elements



- **Surface**
- Pits and underground mine openings
- Tailings impoundments, sludge settling and polishing ponds
- Contaminated surficial materials (arsenic and hydrocarbon)
- Decaying mine infrastructure and buildings with severe arsenic contamination, asbestos insulation
- Junk equipment/scrap lay down areas
- Mine roads
- Alignment of Baker Creek

Remediation Plan Elements

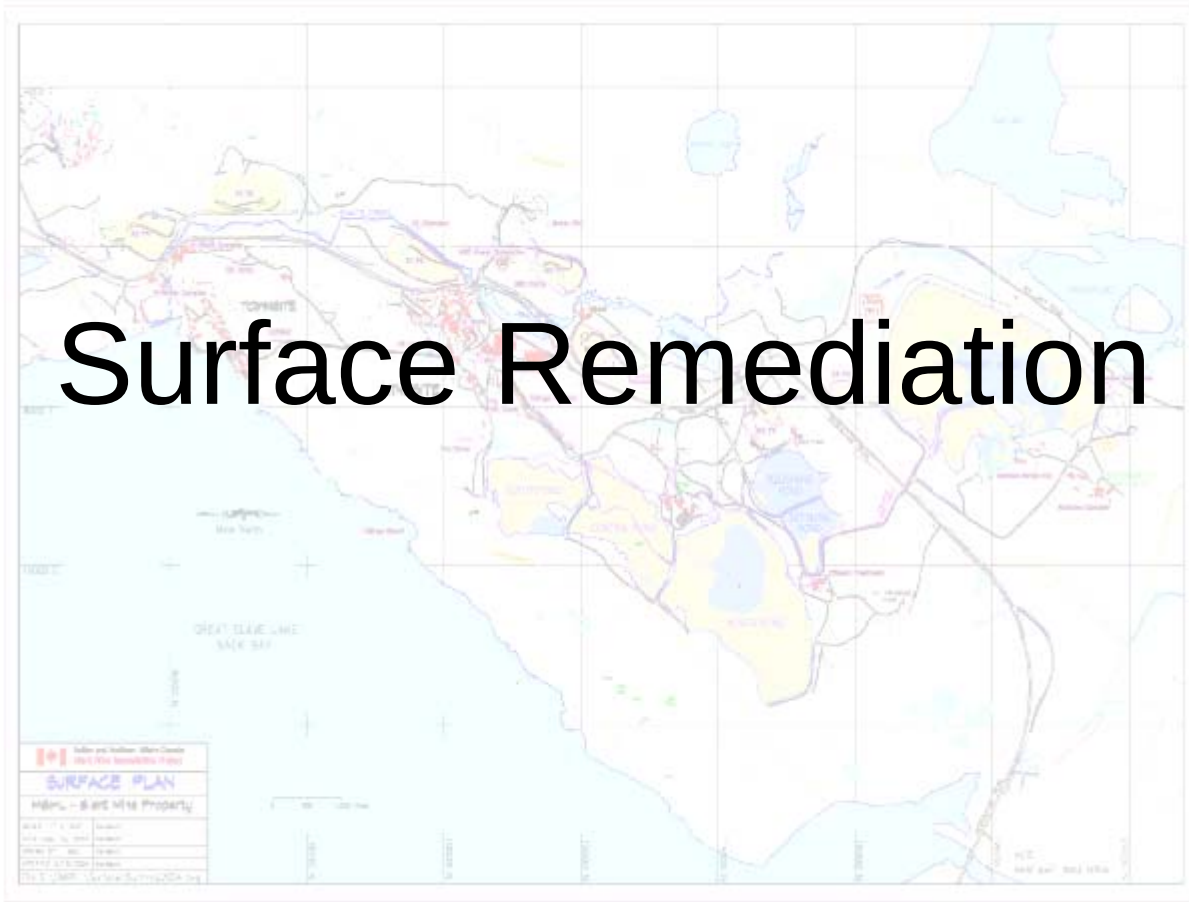


➢ **Underground**

- 237,000 tonnes toxic arsenic trioxide dust stored in sealed rock chambers – in situ freezing

– **Requirement for indefinite period of effluent treatment**

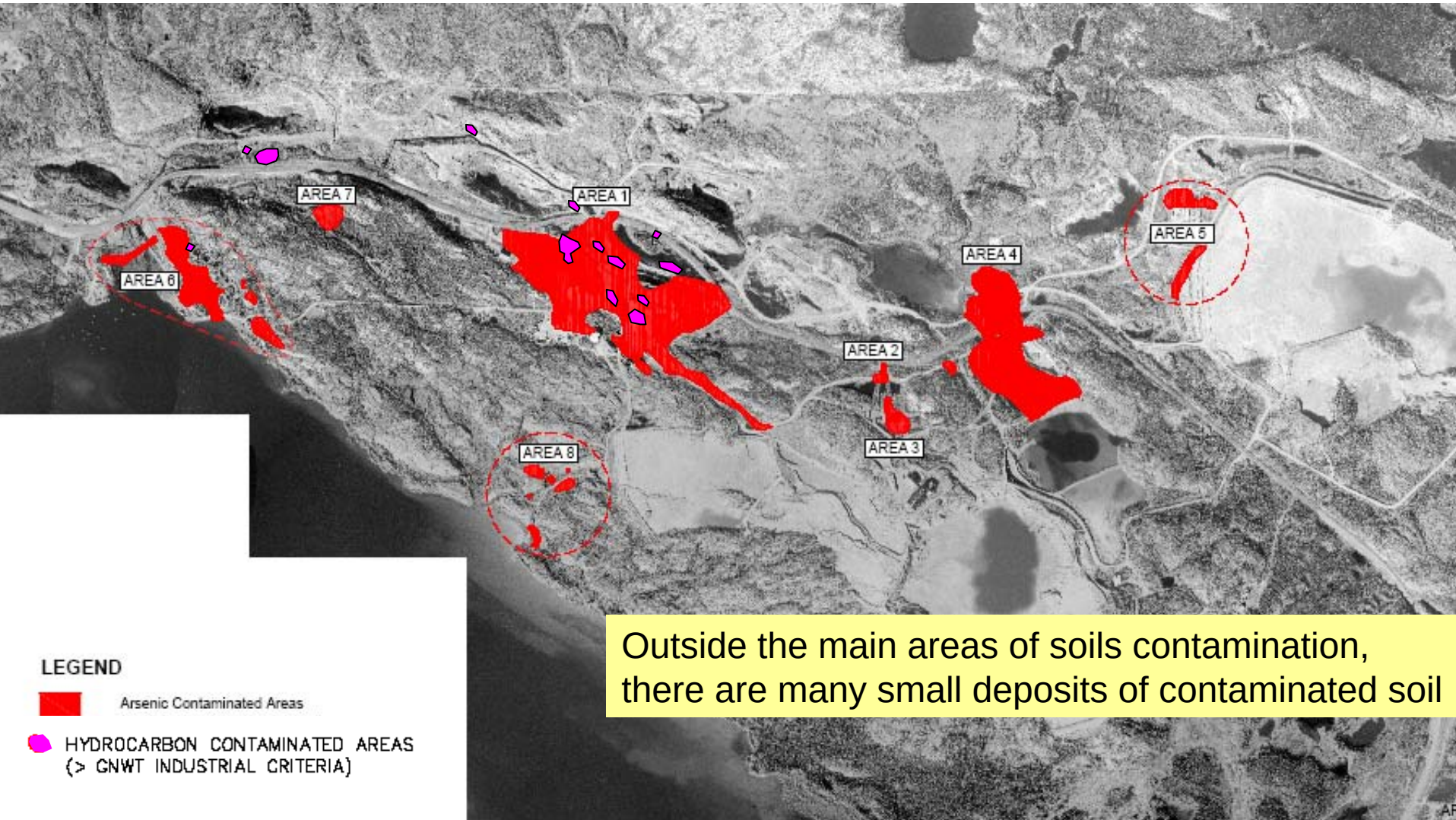
Surface Remediation



- **All existing infrastructure with no future use will be decontaminated, if necessary, and demolished prior to contaminated soils removal**

Contaminated Surface Materials

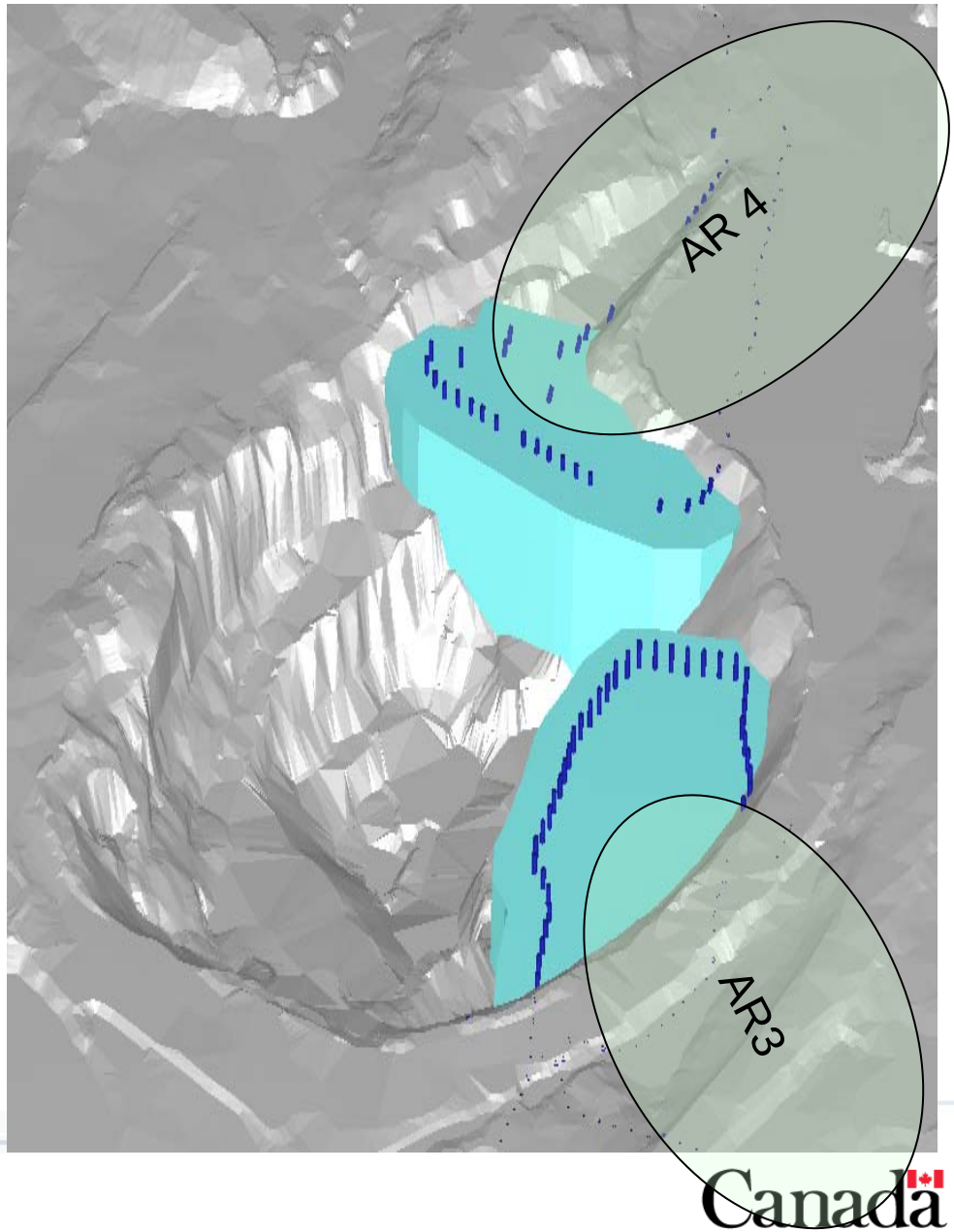
Highly contaminated soils will be removed and placed in one of the open pits for freezing



Outside the main areas of soils contamination, there are many small deposits of contaminated soil

B1 Pit

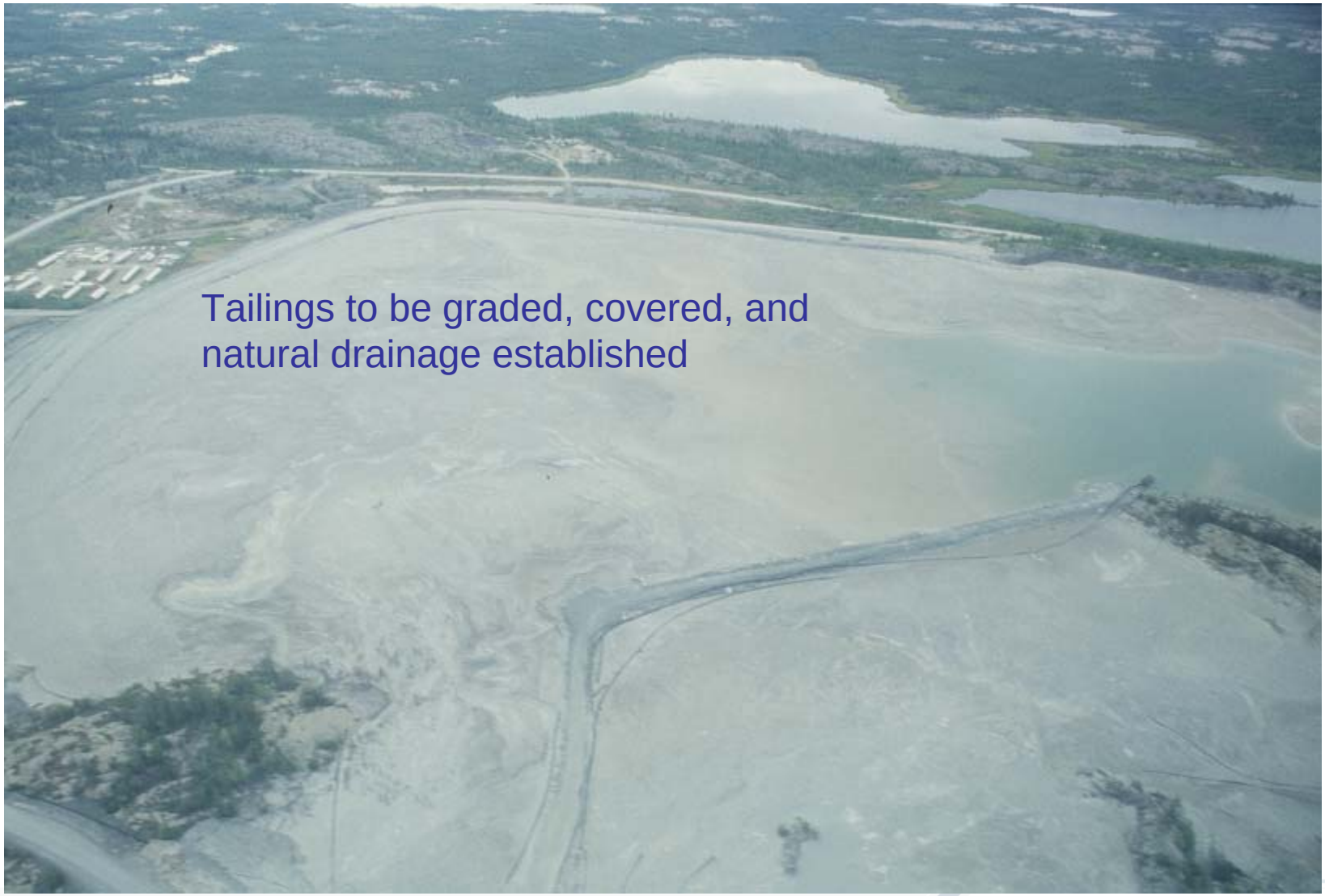
- Requires backfill to construct drill platform for freezing two freeze areas.
- Platform - 60,000 m^3 of contaminated surficial material, >340 mg/kg As to be frozen
- 330,000 m^3 of fill needed to fill pit
- 270,000 m^3 will consist of waste rock, quarry rock or clean demolition debris



Other Pits

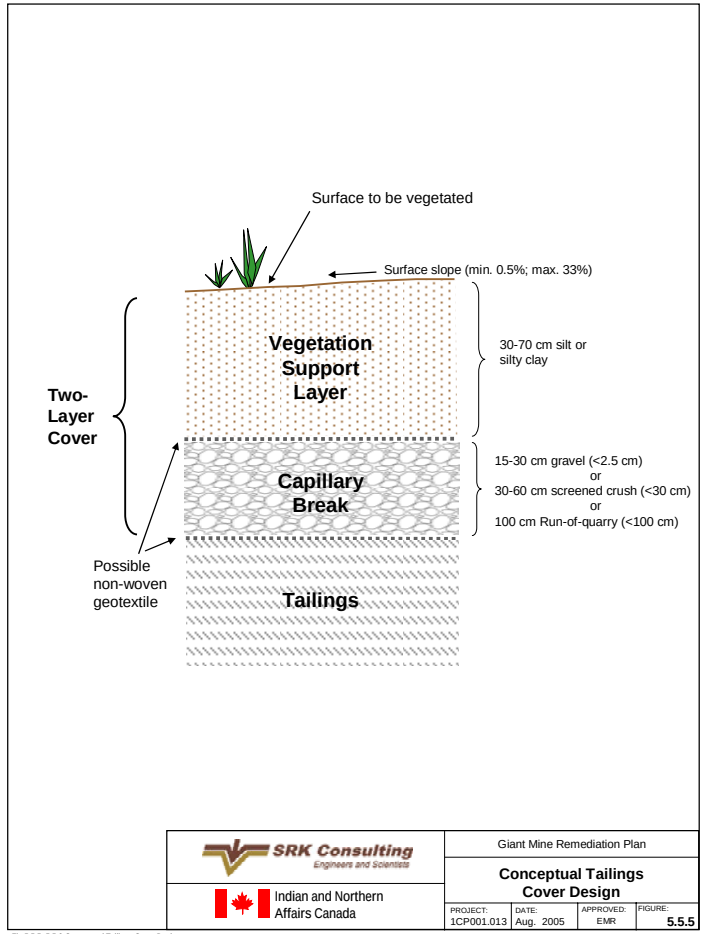
- Some pits will remain open – bermed/fenced
- Pit floors are connected to underground workings which prohibits flooding
- No source of clean backfill without added impacts

Tailings Containment Areas - 95 hectares


Tailings to be graded, covered, and
natural drainage established

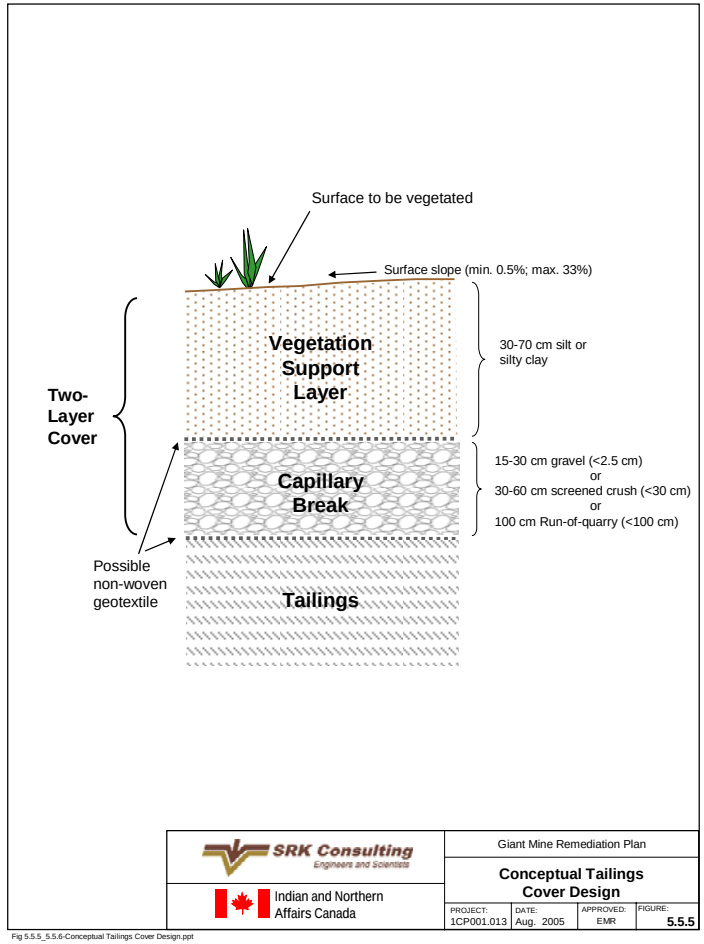
Tailings Cover Design – 2 Layer

- Bottom layer of broken rock has 4 functions:
  1. Physical Barrier to prevent contact with the tailings by humans or animals
  2. Prevents erosion (ATV's, Dirt Bikes)
  3. Prevent upward wicking of arsenic salts through to cover
  4. Helps prevent roots from penetrating tailings



Tailings Cover Design – 2 Layer

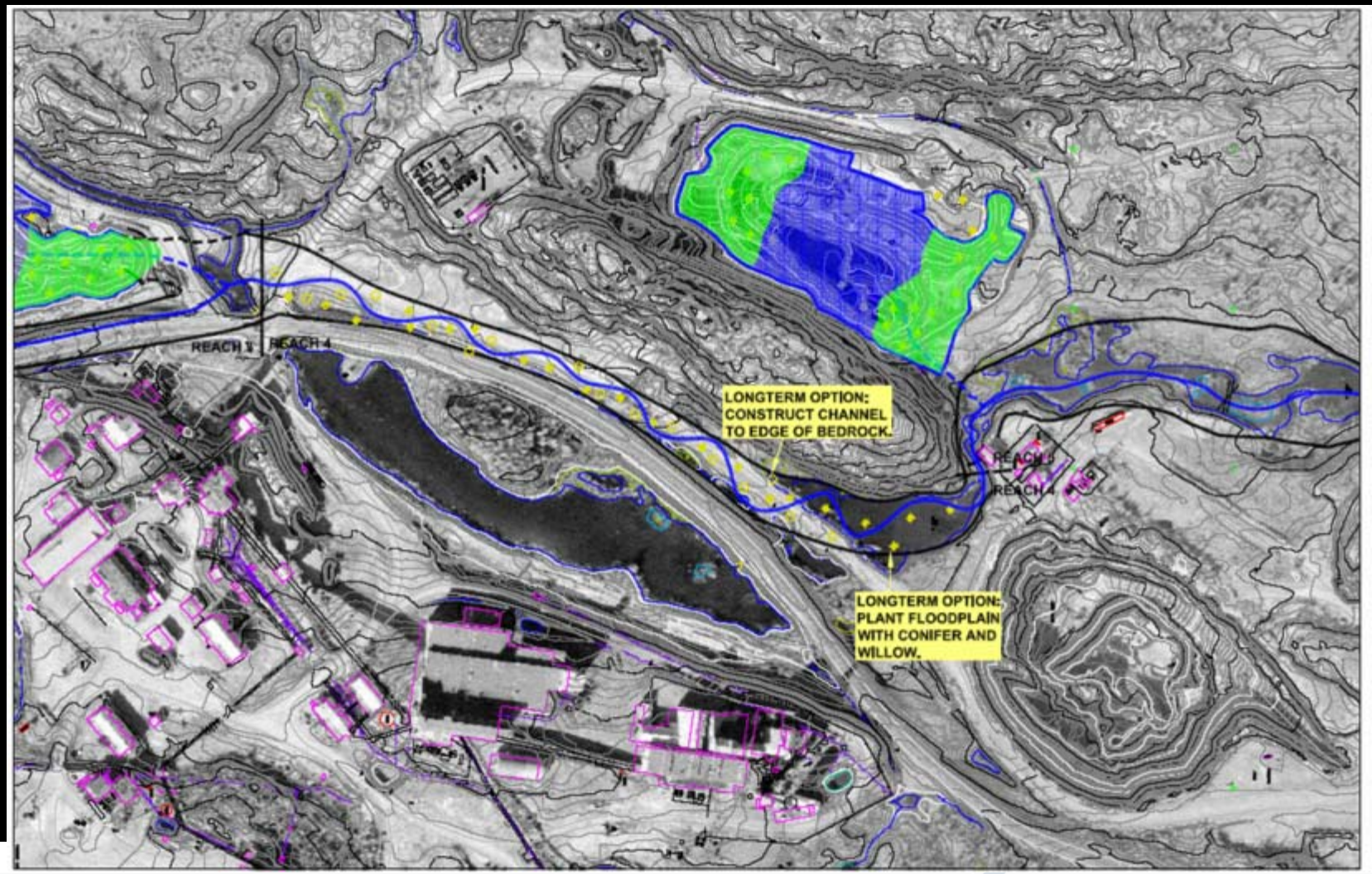
- Upper layer of locally available silt and silty clay will:
  1. Act as clean surface to shed runoff
  2. Allow vegetation to establish
  3. Reduce water infiltration
  4. Allow for future recreational and/or traditional use
  5. Eliminate airborne tailings fines on windy days



Note:
Minimizing infiltration is NOT a primary objective, but the two layer design will reduce infiltration

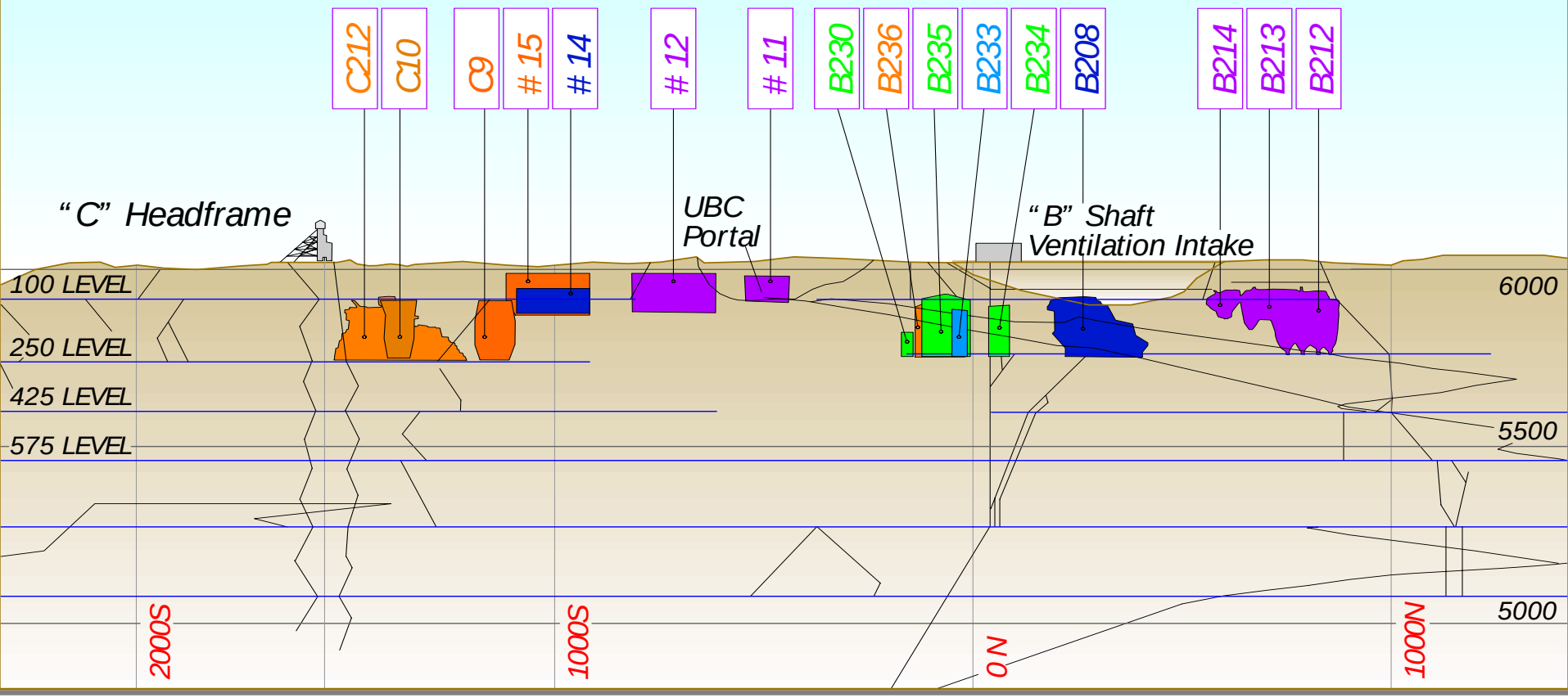
Effluent Treatment Plant and Settling Pond
will be covered using design similar to tailings cover

- Baker Creek Rehabilitation



Underground Remediation

Arsenic trioxide dust in underground storage is enclosed completely in rock – all access drifts sealed by cement bulkheads

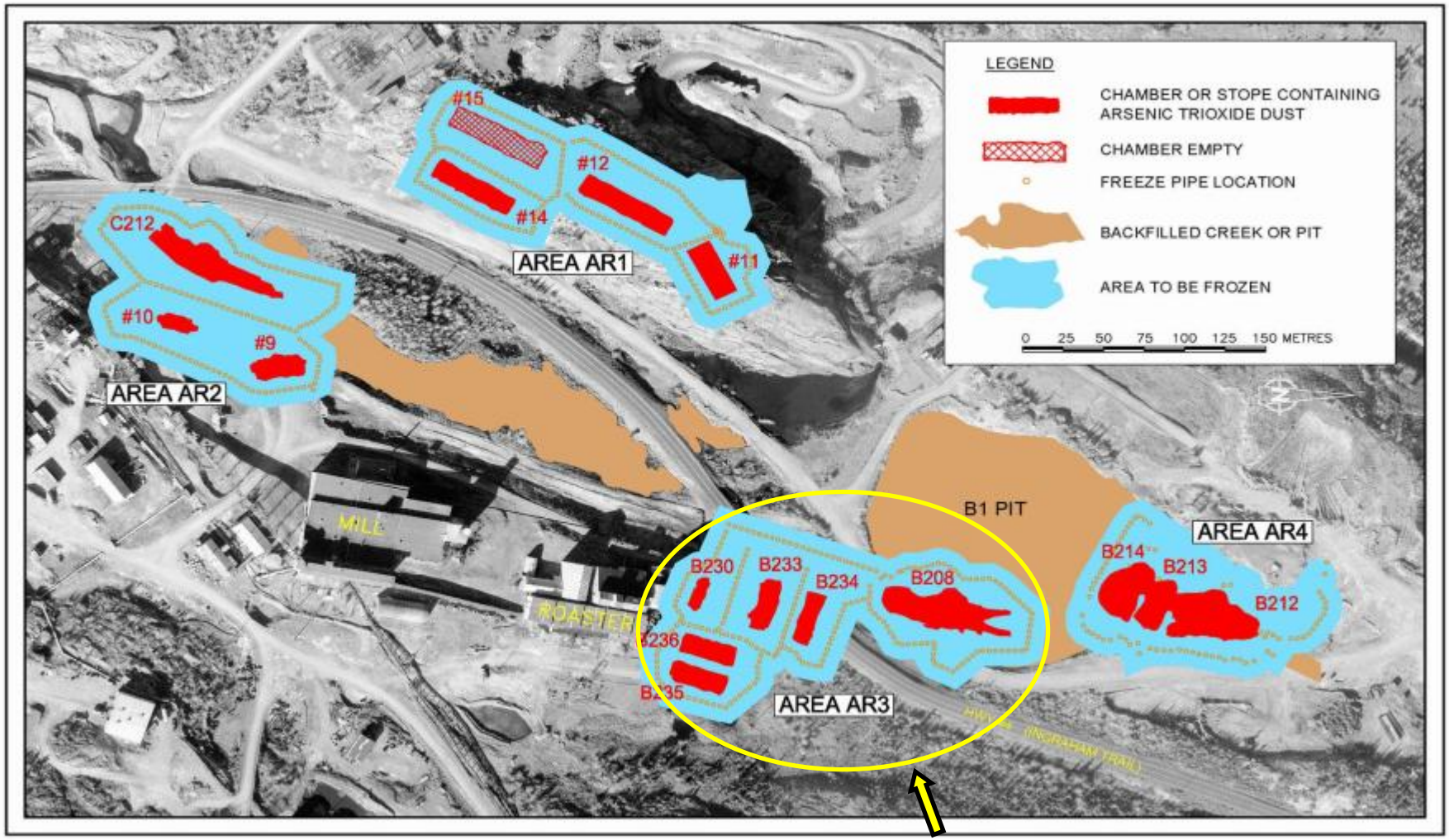


Arsenic Chambers Long Section: **10 Chambers & 5 Stopes**

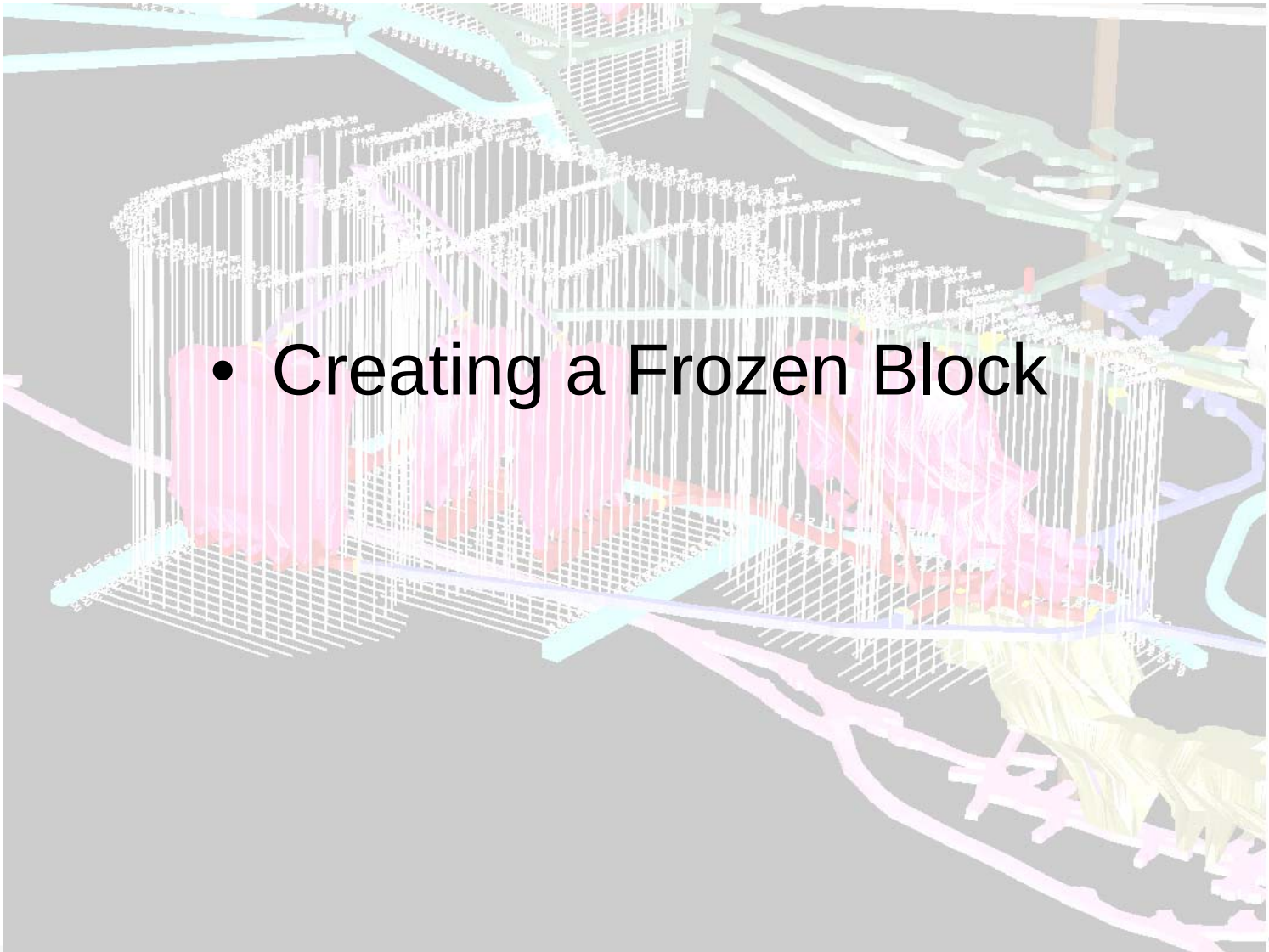

Underground Remediation

Underground Contamination Areas

#1 > Four Separate Arsenic Trioxide Storage Areas to be Frozen

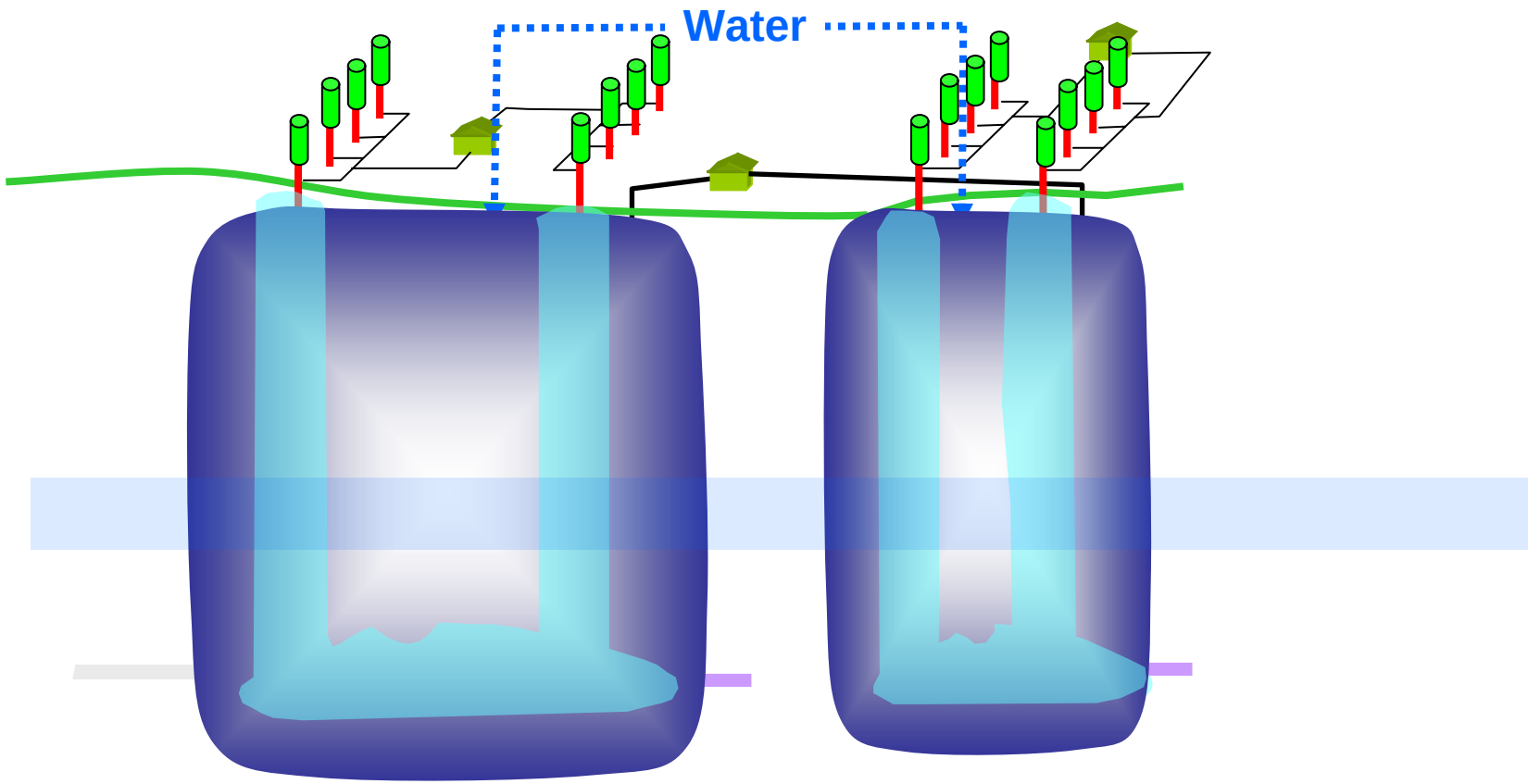


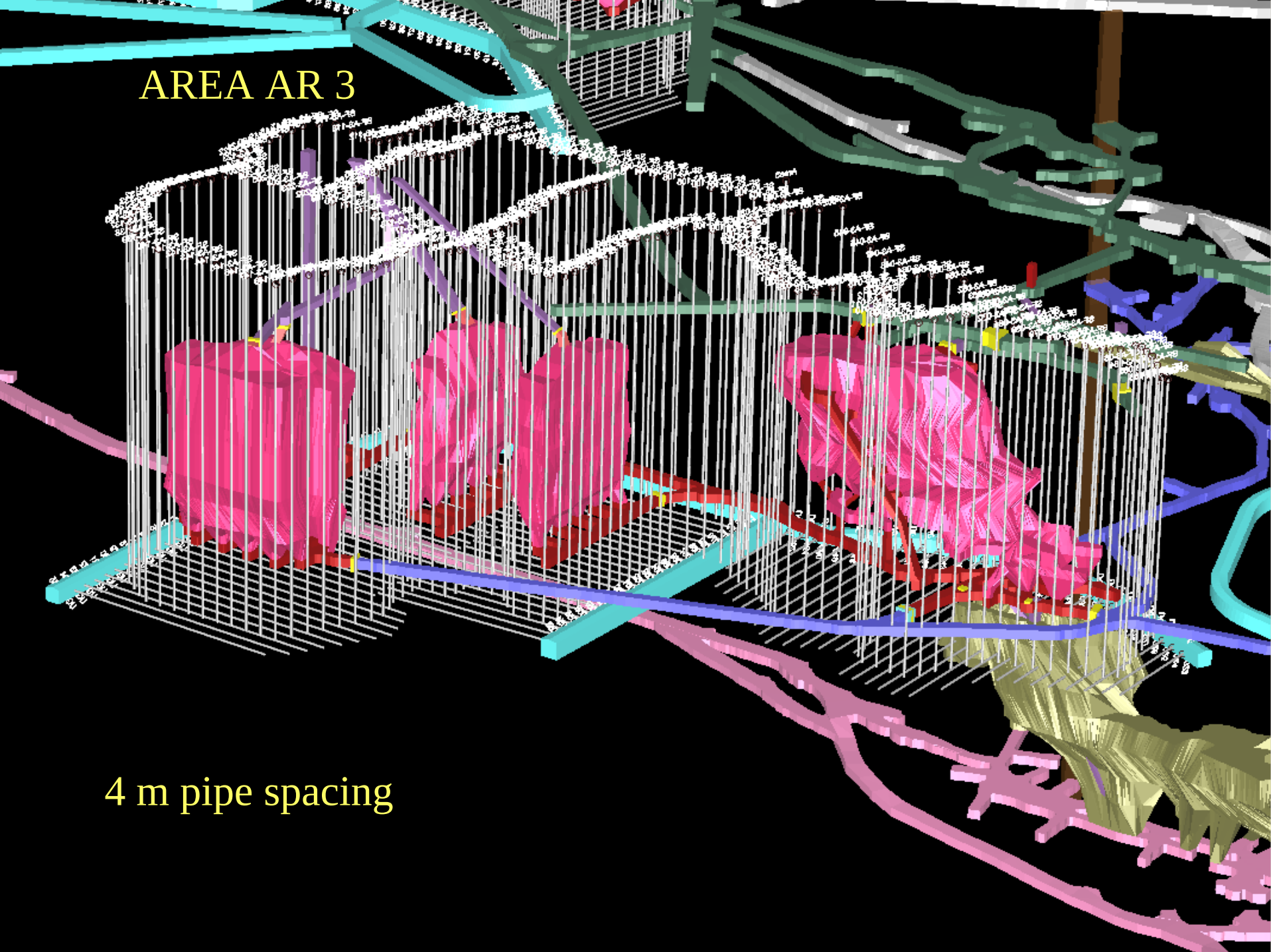
B208 CHAMBER – True Scale to Precambrian Bldg



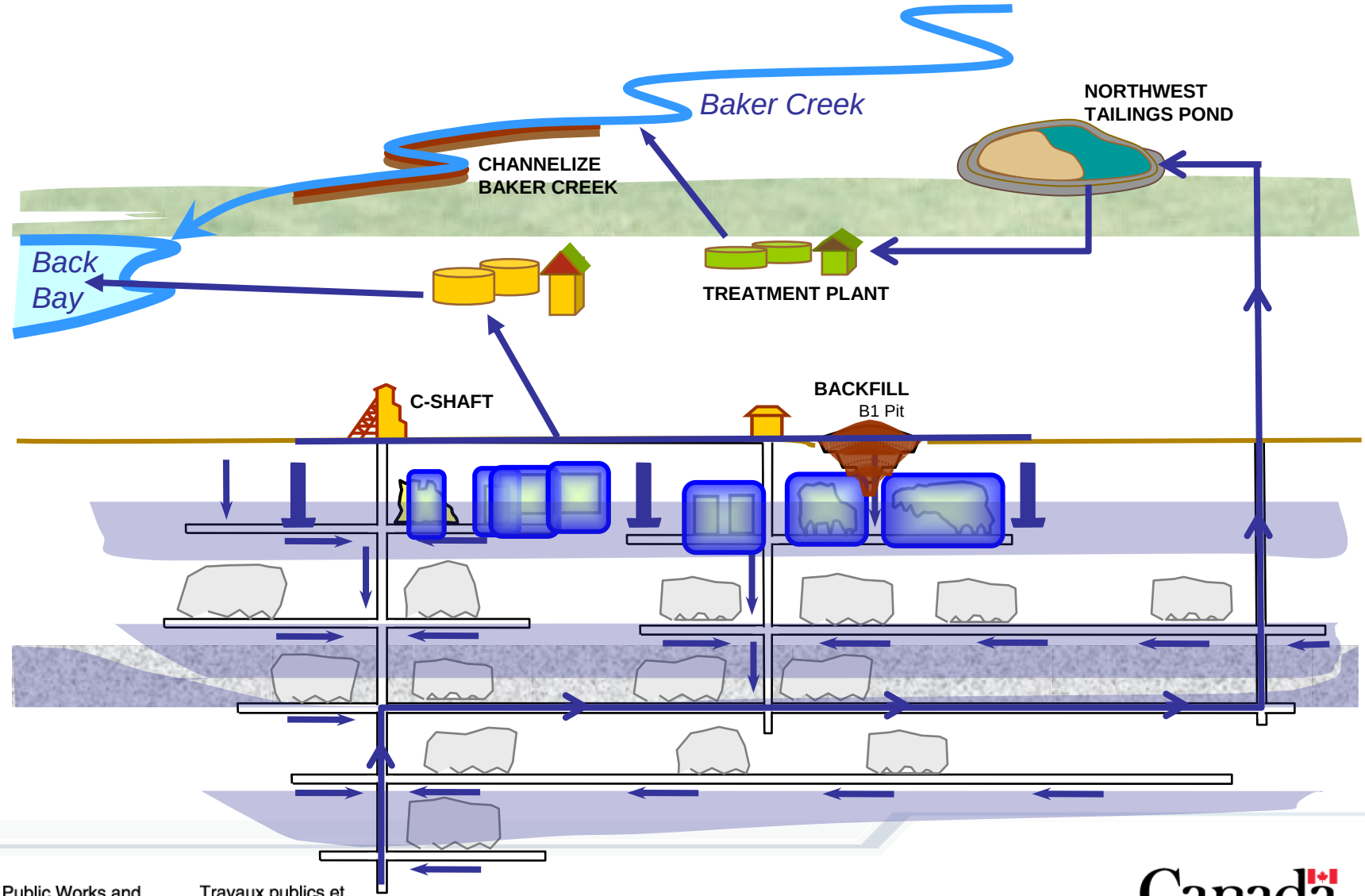
- Creating a Frozen Block

Freezing and Water Management Sequence

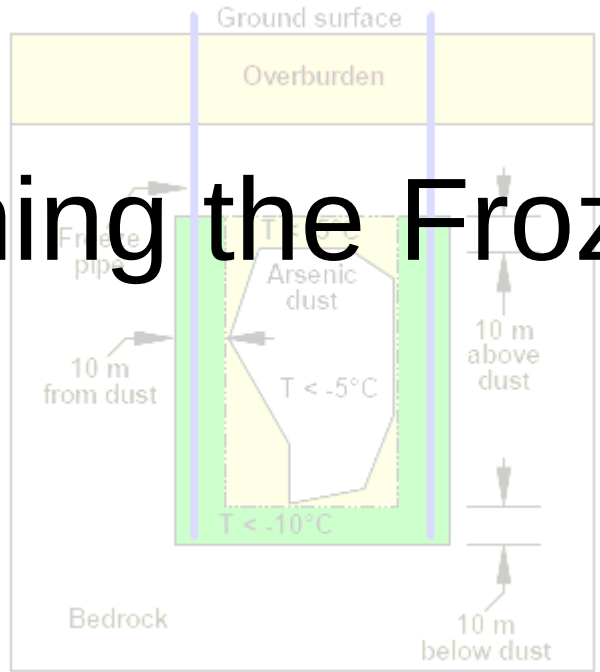



AREA AR 3
4 m pipe spacing

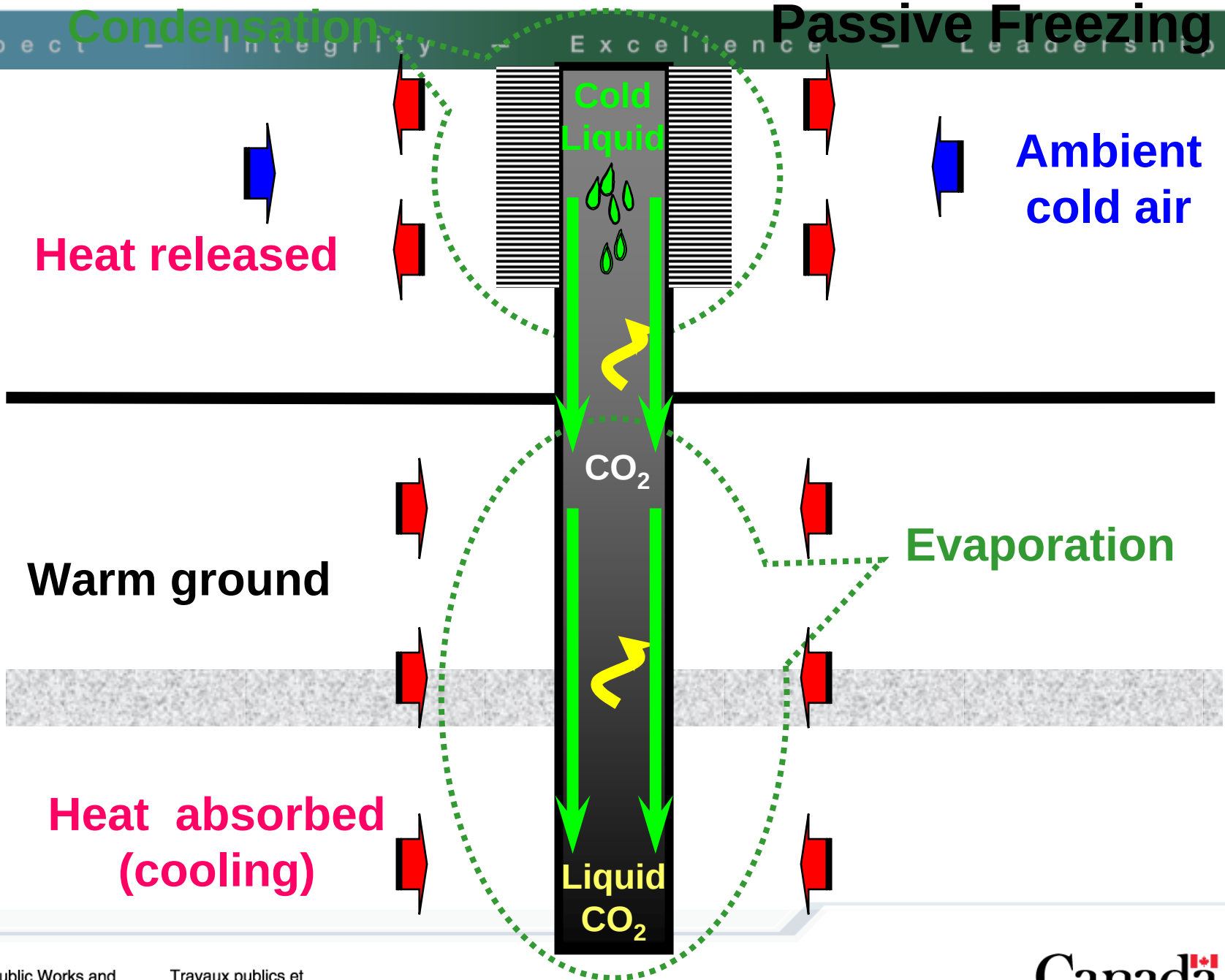
Frozen Block Events



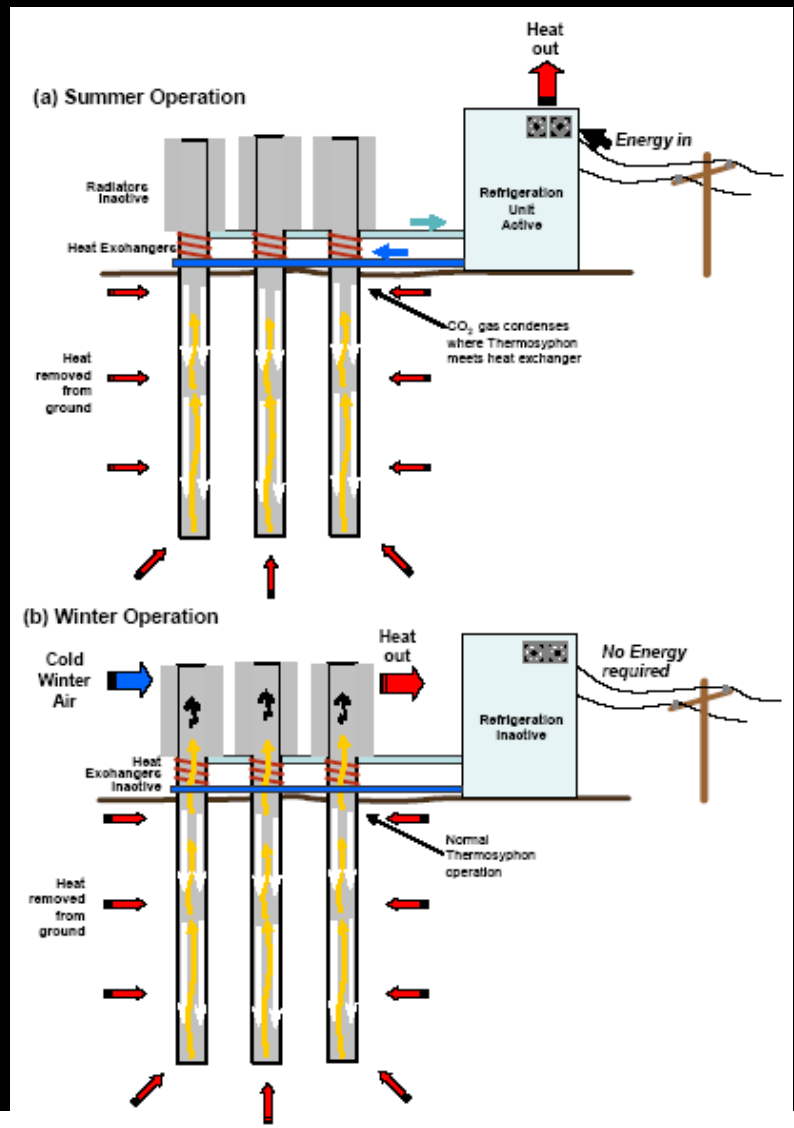
Maintaining the Frozen Block



Condensation Passive Freezing

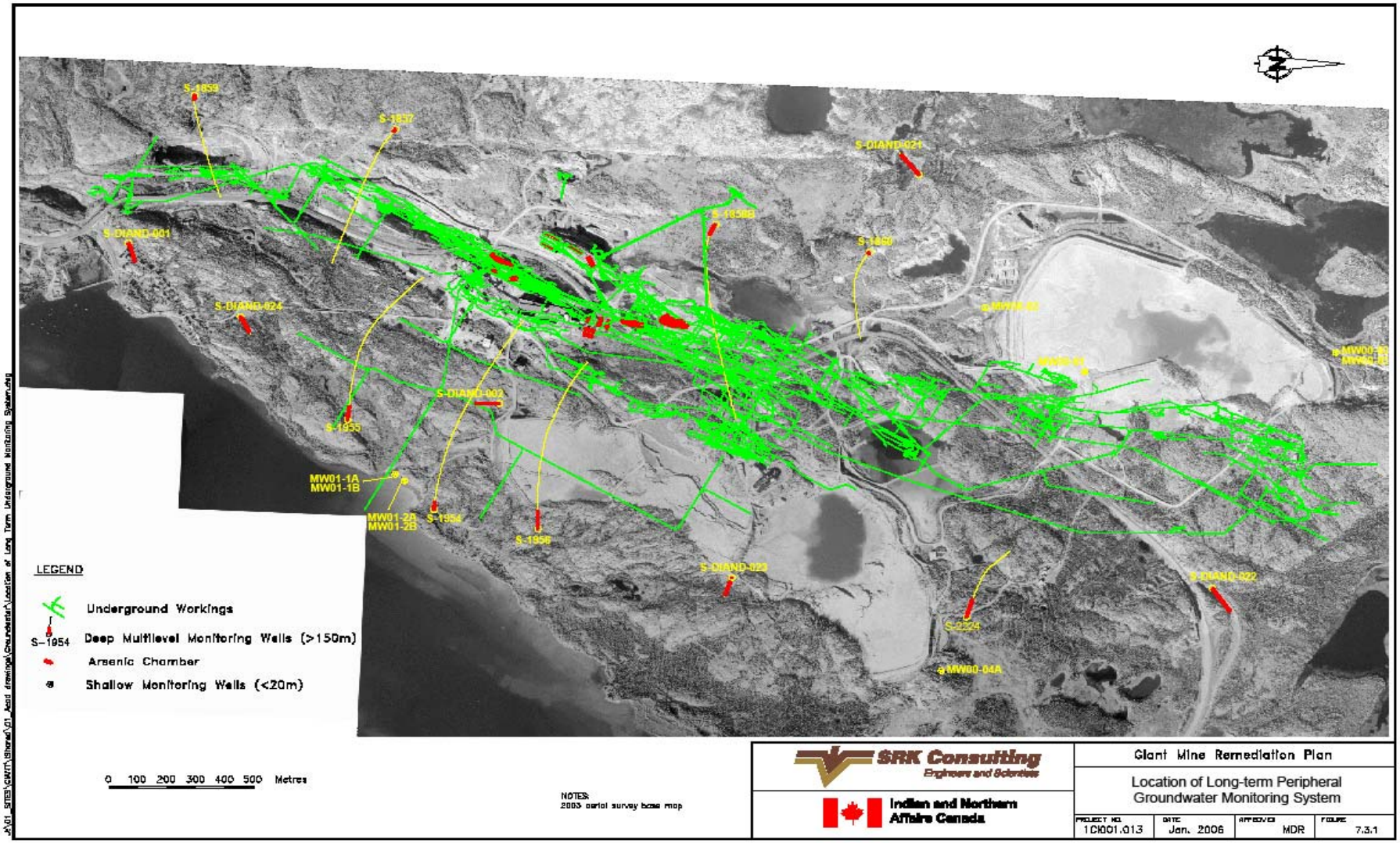


Hybrid thermosyphon conceptual design



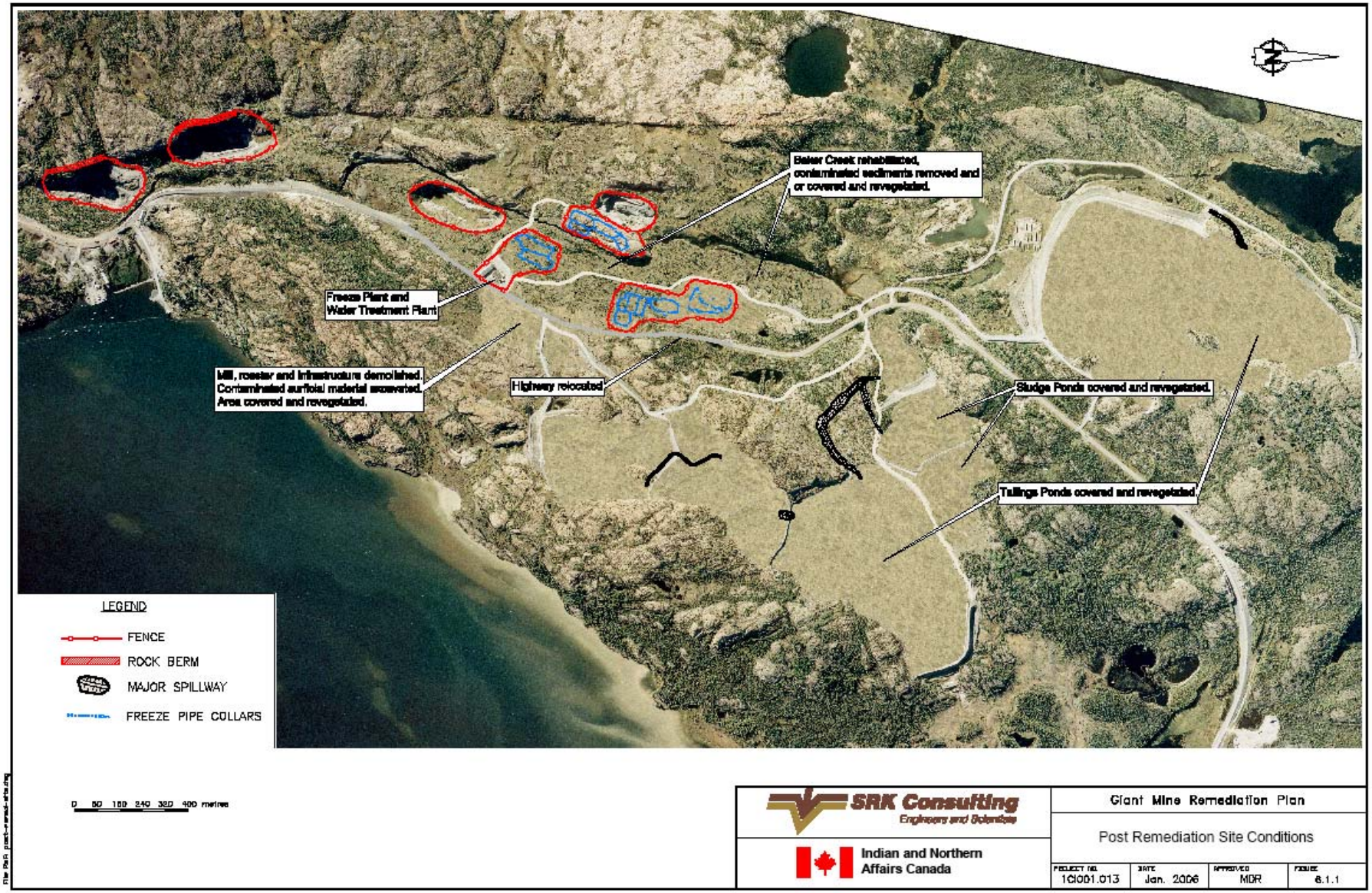
Hybrid Thermosyphons
Diavik Diamond Mine

Groundwater Monitoring



Giant Mine Remediation Plan

Site – Post Remediation



Giant Mine – Recent Risk Mitigation Works

Rechanneling Reach 4 of Baker Creek

Baker Creek – Bitumen Liner

75 ton bridge installation over new creek alignment

Baker Creek Reach 4 - Complete

Baker Creek Reach 4 – 2009

B2 Dam Reconstruction

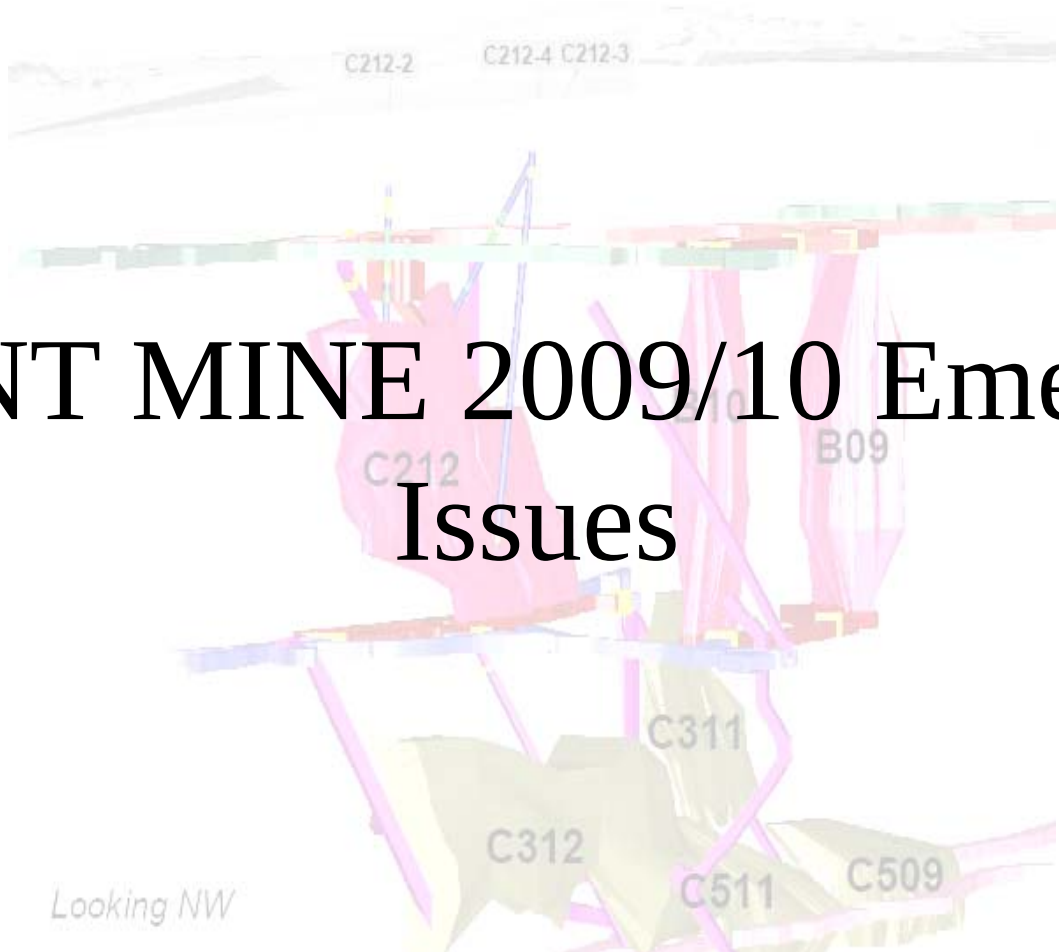
B2 Dam – All clay excavations had to ripped

B2 Dam – Clay had to be heated for shaping

B2 Dam – Heating Clay at -35C

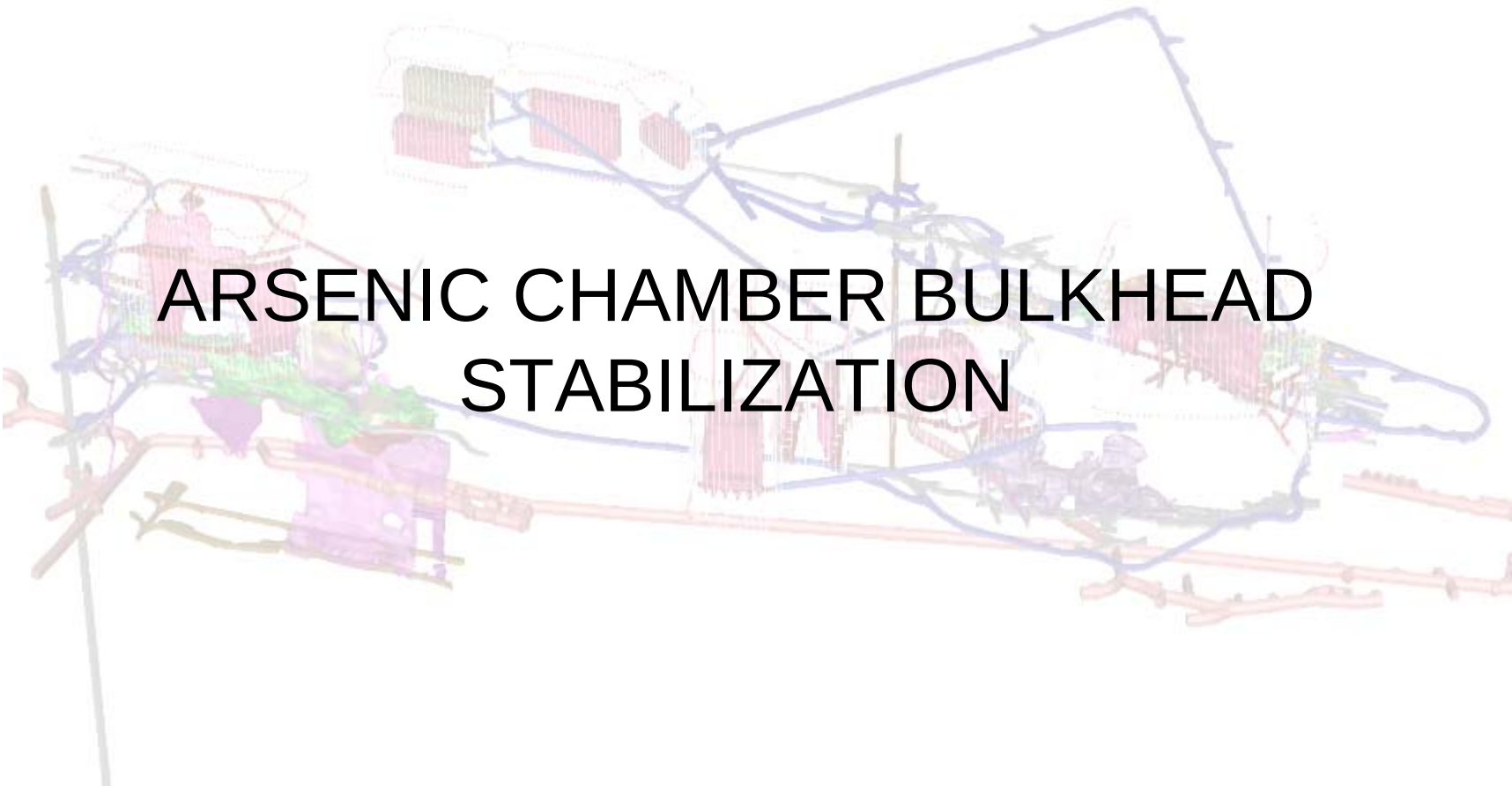
B2 Dam – Field Engineering &Challenging Geometry

Completed Baker Creek & B2 Dam



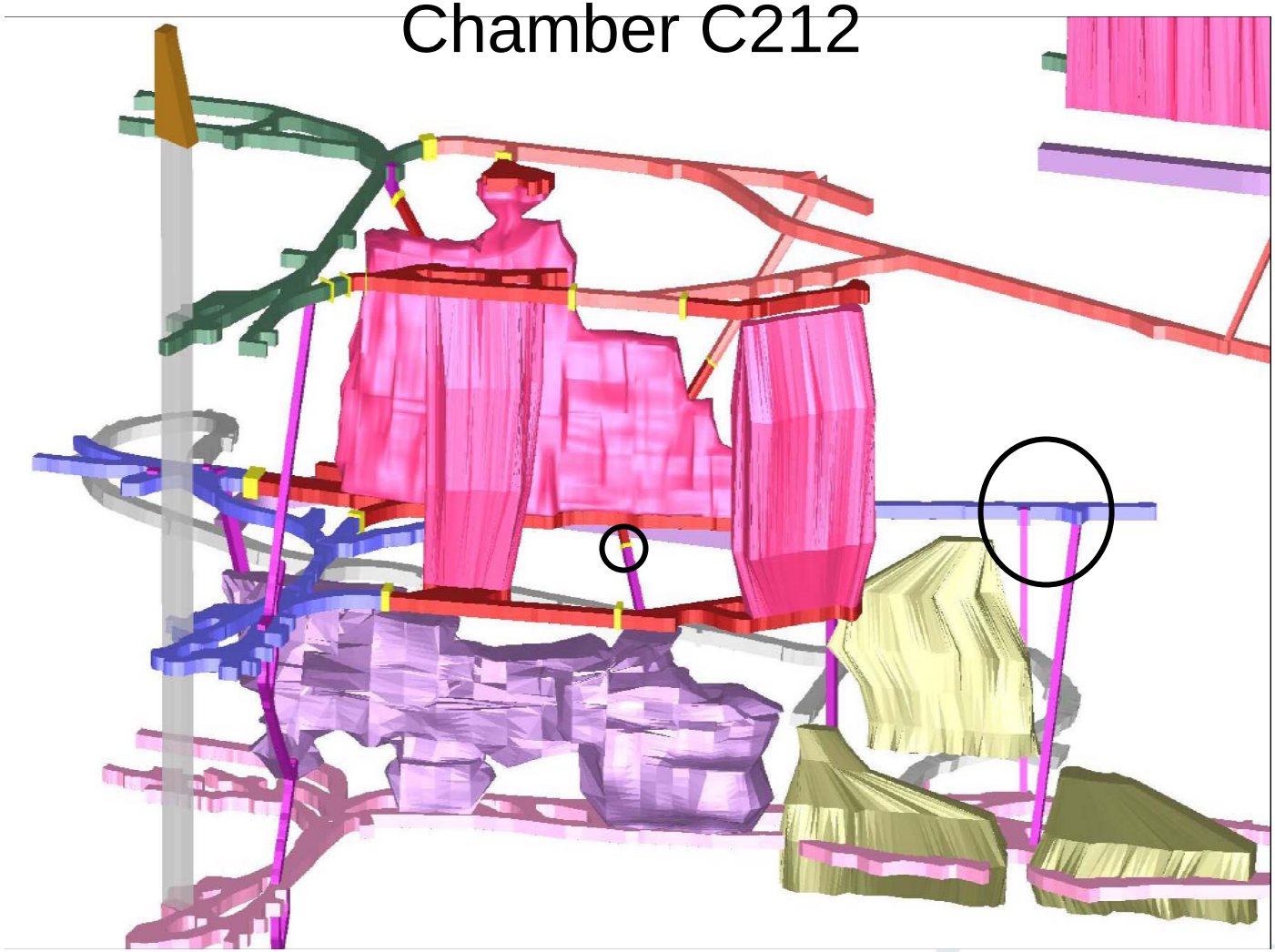
GIANT MINE 2009/10 Emerging Issues

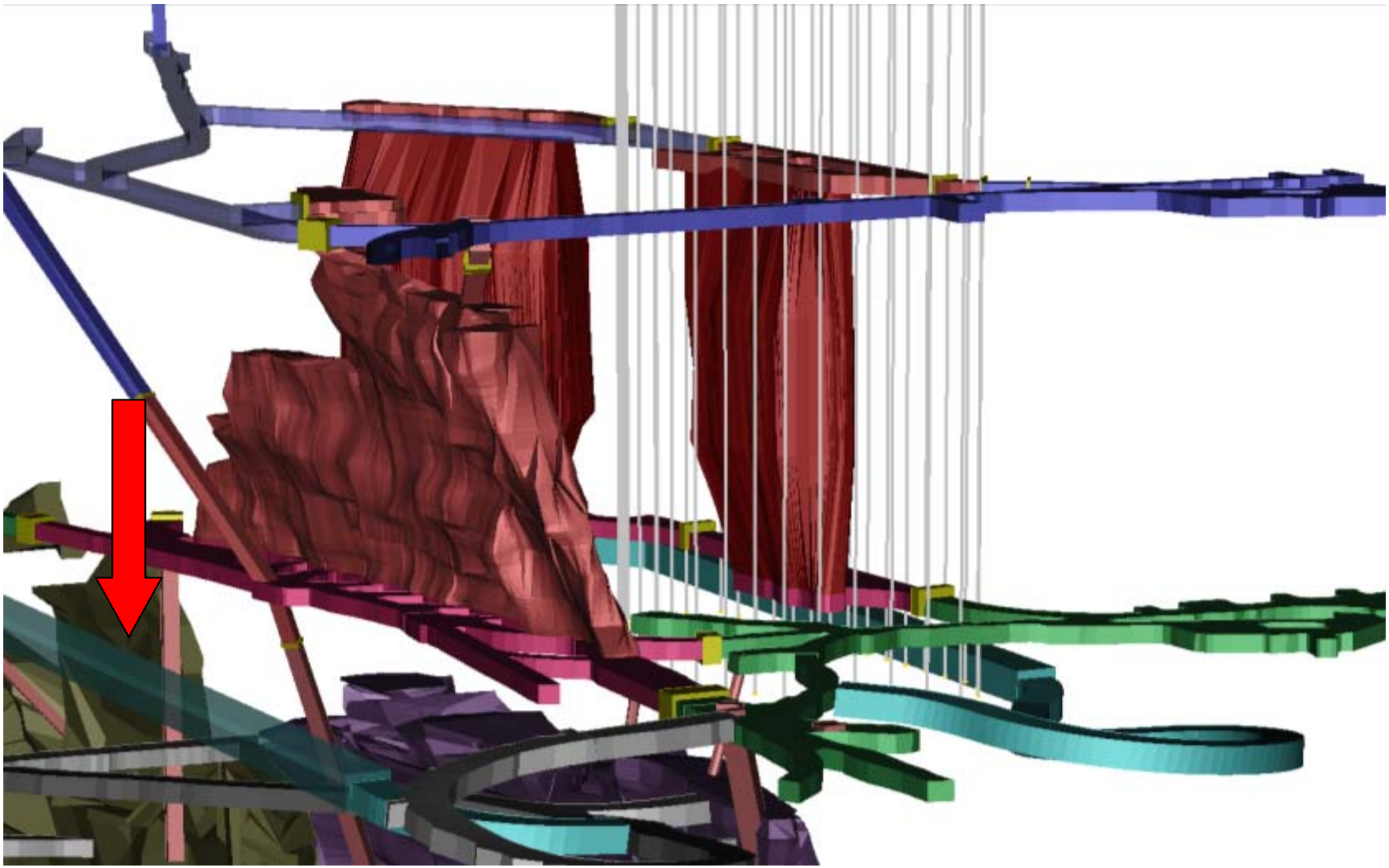
Effluent Treatment Plant



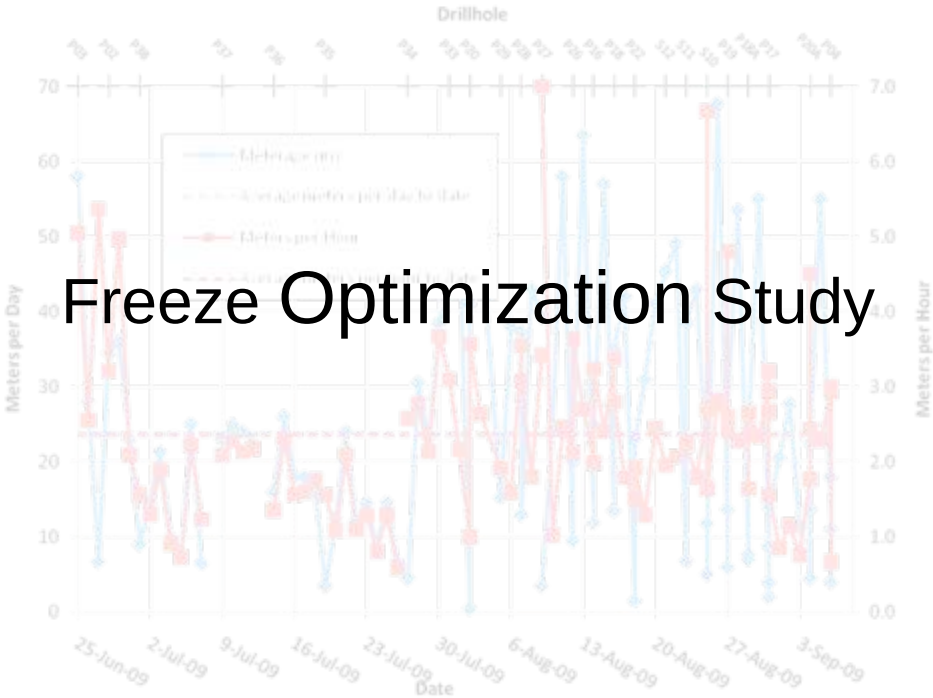
ARSENIC CHAMBER BULKHEAD STABILIZATION

Stabilization of Bulkheads #47,48 & 49 Chamber C212

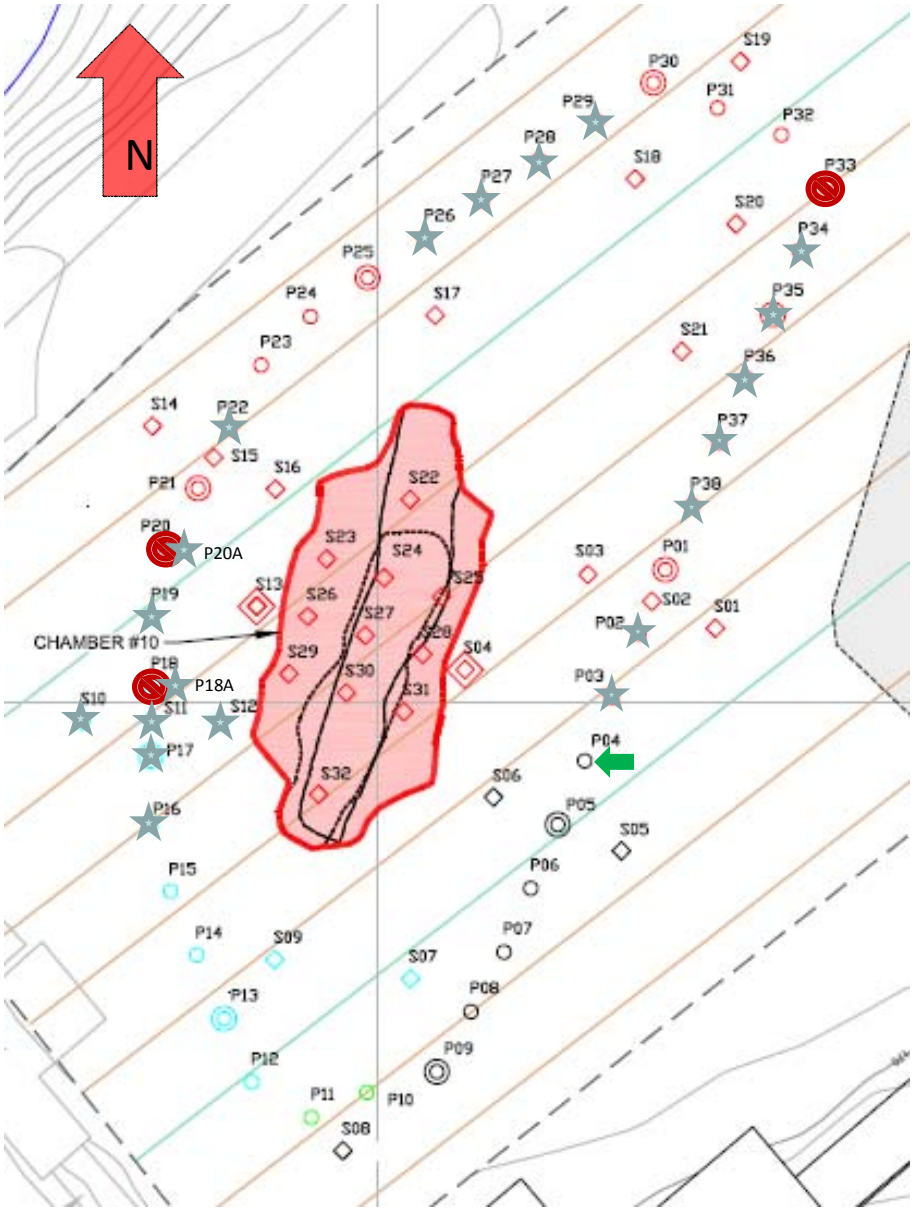




Freeze Optimization Study



FREEZE OPTIMIZATION STUDY Chamber 10



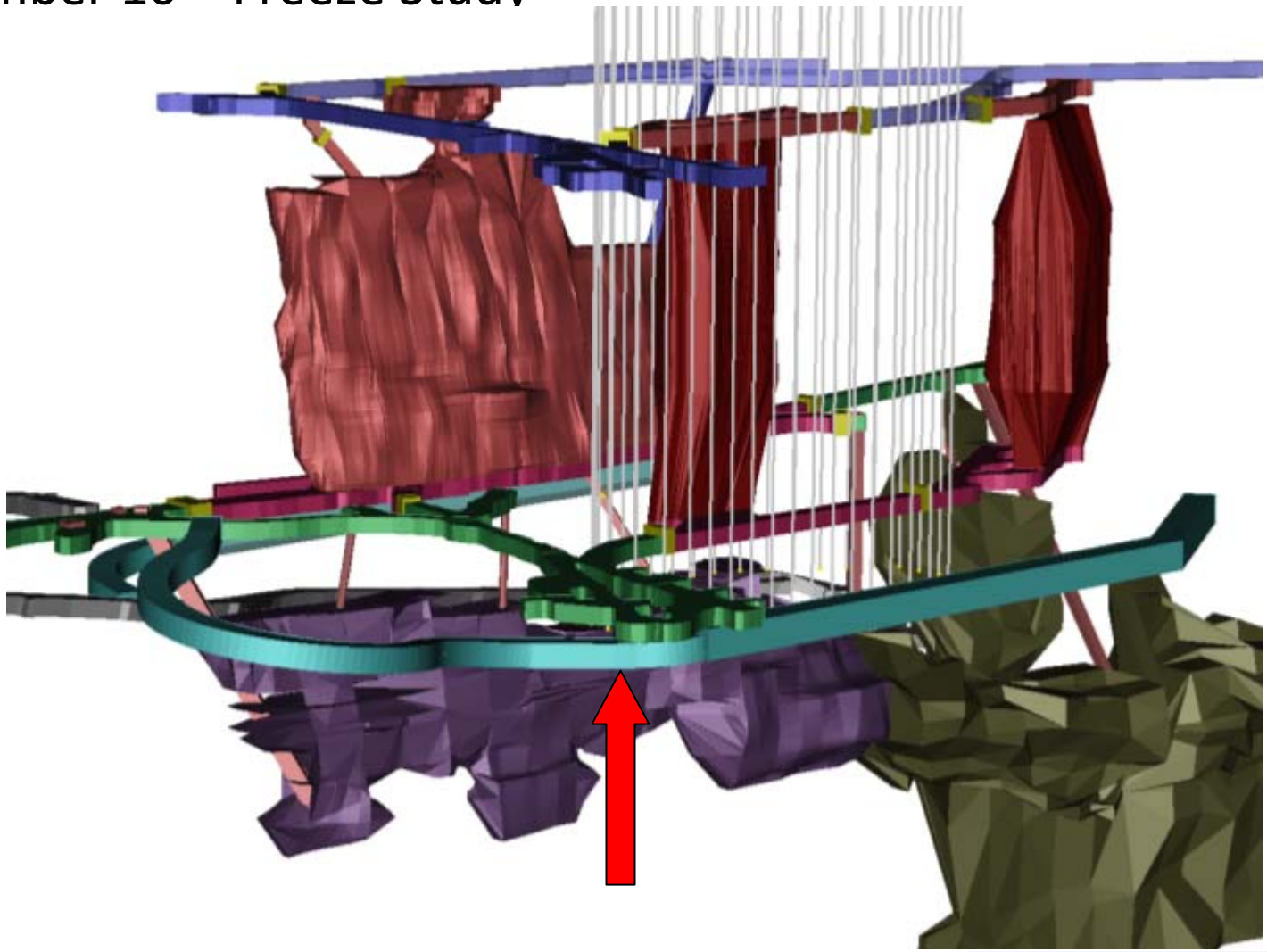
- Forty freeze holes
- Forty instrumentation holes
- The optimization study will produce the 10 meter containment, sides and bottom as planned for all the freeze zones.
- Three types of drilling types being evaluated:
  - Rotary Mud
  - Down Hole Hammer and
  - Diamond Core

LEGEND

- Mud Rotary Hole in progress
- Down Hole Hammer Hole in progress
- Diamond Core Hole in progress
- Completed Borehole
- Abandoned Holes

- Freeze Hole by Mud Rotary
- Freeze Hole by DHH
- Freeze Hole by Coring
- Freeze Hole - Method to be determined
- Instrumentation - Mud Rotary
- Instrumentation - DHH
- Instrumentation - Core
- Core Recovery Required (outlined marker)

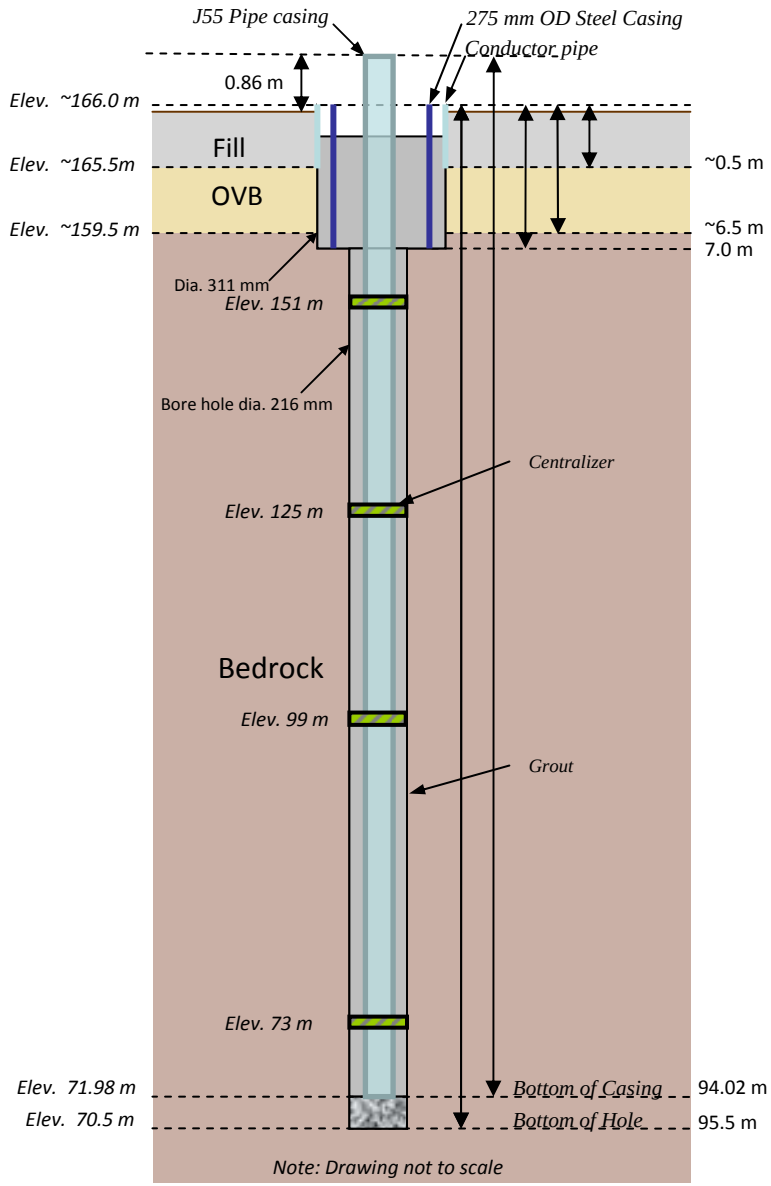
Chamber 10 – Freeze Study



Drillhole Summary

Project: Freeze Optimization Study
Drill Type: Mud Rotary

Hole ID : P20A
Drilled by: Calibre Drilling



	Planned		Actual	
P27	Drillhole	J55 Casing	Drillhole	J55 Casing
Length (m)[1]:	94.0	94.0	95.5	94.88
Diameter (mm):	171	114 OD	216	114 OD
Top Elev. (m):	166.0	166.6	166.0	166.86
Bottom Elev. (m):	72.0	72.0	70.5	71.98
Pipe Stick-up (m):	-	0.6	-	0.86

Notes: 1. Planned datum is design post-site preparation ground surface; actual datum is the top of conductor pipe.
2. Planned bottom elevation of drill-hole includes 1m sub-drilling allowance.

Date	Progress
09/04/2009	•Drill to 22.5 m (2.4 m/hr drill rate)
09/05/2009	•Drill to 84.5 m (2.3 m/hr drill rate)
09/06/2009	•Drill to 95.5 m (2.9 m/hr drill rate)

Date	Notes
09/04/2009	• Moved to borehole P20A at 12:00 • Started drilling at 13:30 • Thermistor string to be installed to the freeze pipe inside the J55 casing to prevent damaging the thermistor cable
09/05/2009	• Loss of circulation at 84.5 m
09/06/2009	• Complete borehole and install J55 casing

Freeze Optimization Study