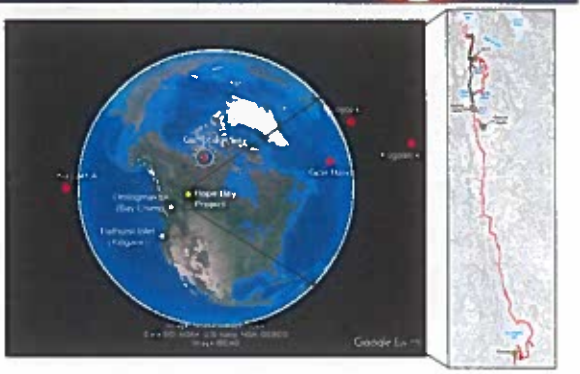
Project Location



Approved Doris Project (2AM-DOH1323)

Existing Permits and Licences - Doris

Project Certificate

- Issued 2006, Amended 2016
  - Allows Construction, Development, Production, Closure
  - Environmental compliance and protections
  - 2000 tonnes per day
  - Discharge Effluent to Roberts Bay

Type A Water Licence 2AM-DOH1323

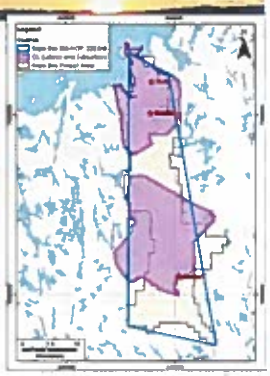
- Issued 2007, Amended 2016, Applies from 2013 to 2023
  - Water Use
    - Doris Lake - 480,000 m³ per year - Mining and Processing
    - Windy Lake - 22,000 m3 per year - Domestic
    - Reclaim Water – no limit - Processing
  - 2.5 million tonnes to Tailings Area
  - Reclamation Security - $31 Million

All operations comply with all Federal and Territorial laws and regulations

- Effluent to comply with Metal Mining Effluent Regulation

Type BE Water Licence - Exploration

- Type B Water Licence 2BE-HOP1222
- Issued 2012, Expires 2022 (renewable)
- Entire Hope Bay Property
- Permitted Activities
  - Surface Exploration and Drilling
  - Water Use – 343 m3 per day
  - Domestic water use at Doris Camp
  - Construct new camp (180 persons)



Madrid Type BB Water Licence

- Type B Water Licence 2BB-MAE1727
- Madrid North and South
- Issued 2017 – Expires 2027 (renewable)
- Permitted Activities
  - Surface and underground exploration
  - Extract 50,000 tonnes bulk sample from each of Madrid North and South
  - Construct surface facilities and roads
  - Haul ore to Doris Plant
  - Water Use
    - 108,000 m3 per annum, 295 m3 per day
- Reclamation Security Bonds (60 days before activity - proposed)
  - Madrid North - $4 million
  - Madrid South - $3.1 million
  - Roads - $17 thousand

Boston Type BB Water Licence

- Type B Water Licence 2BB-BOS1217
- Renewed 2017, Expires 2027 (renewable)
- Permitted Activities
  - Surface and underground exploration
  - Extract bulk sample
  - Construct surface facilities, roads and camp
  - Water Use - 100 m3 per day
  - Winter road access from Doris
  - Scope includes:

"...camping, prospecting, drilling, bulk sampling, operation of a bulk sampling and crushing and sorting plant, underground development, the operation of a fuel storage facility, a landfarm facility, and sampling for environmental baseline data collection."

Monitoring and Reporting

- **Aquatic Effects Monitoring Plan**
- **Environmental Effects Monitoring Program**
- **Surveillance Network Program**
  - Type A Water Licence – monthly
  - Type B Water Licence(s) – monthly
- **NWB Annual Reports**
  - Type A and Type B Water Licence
  - Due March 31

Madrid- Boston Project Highlights

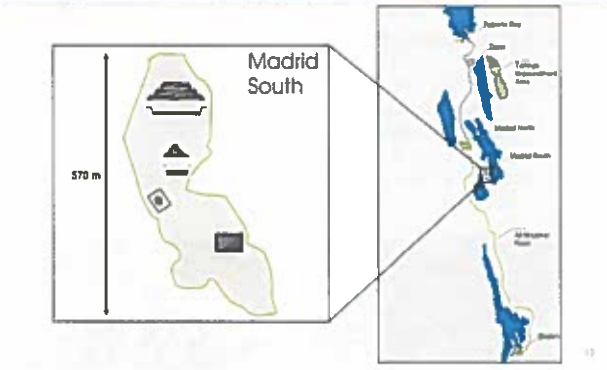
Madrid and Boston Highlights	
Mining	• Underground mining and crown pillar recovery with waste rock stored above ground temporarily and then put back into the underground mines.
Processing	• Nominal capacity of 6,000 tonnes of ore processed per day
Gold Production	• Gold production at Doris and Boston. Concentrates produced at Madrid North
Transportation	• Sealift arrives at Roberts Bay and utilize cargo dock and jetty • Gold bars flown out to market from Doris and Boston • Road connecting Madrid and Boston to Doris and Roberts Bay
Employment	• Fly in-fly out operation from Edmonton and Kitikmeot • 870 workers during peak operations (for approximately 14 years)
Economic Benefit	• Royalties, mineral taxes and other payments of approximately $500 million over the life of the Hope Bay Project for Canada, Nunavut, KIA and NTI (excluding Doris)

Hope Bay Project Layout

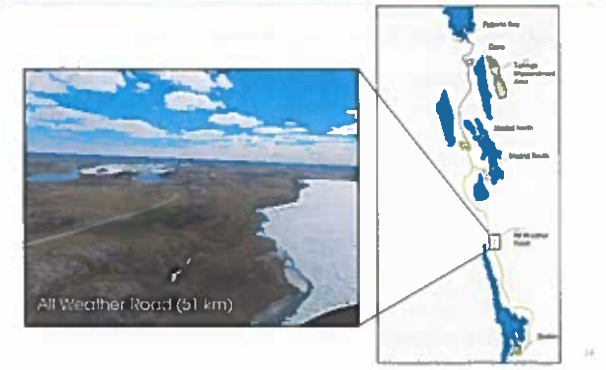
Hope Bay Project Layout

Hope Bay Project Layout

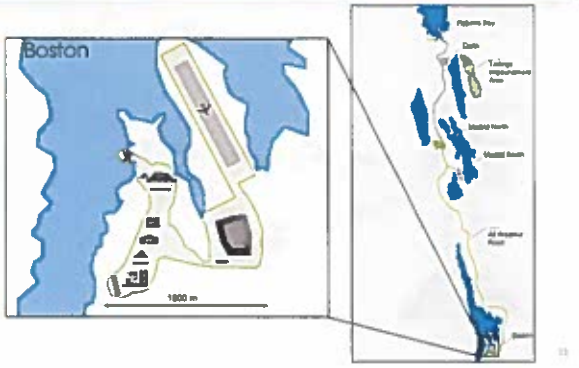
Hope Bay Project Layout



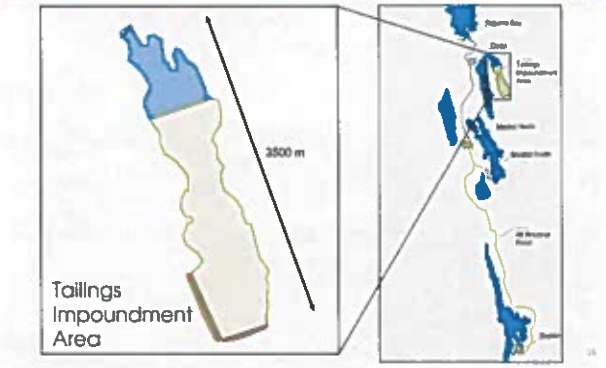
Hope Bay Project Layout



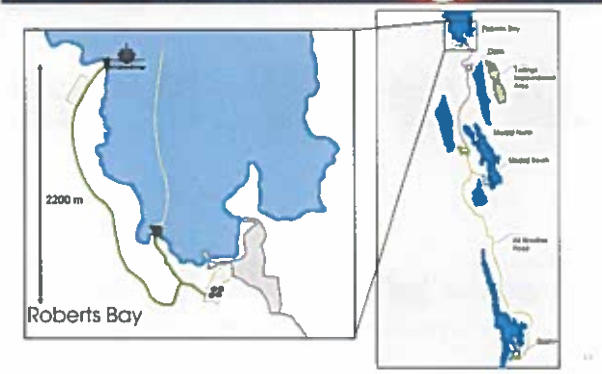
Hope Bay Project Layout



Hope Bay Project Layout



Hope Bay Project Layout



Proposed Amendment No. 2 Type A

- **Scope includes Doris, Madrid Sites and All Weather Road**
  - Expand 2AM-DOH1323 Amendment No. 1 by incorporating into this Licence the scope of all facilities and activities authorized under the Type B Licence 2BB-MAE1727
    - Camp Capacity – 400 persons
    - Expand TIA capacity to 18 million tonnes
    - Water Allowance:
      - Domestic from Windy Lake: 43,800 m3/year
      - Industrial from Doris Lake: 1,930,000 m3/day
    - Concentrator at Madrid
    - AWR to Boston
    - **Allows commercial mining**

Proposed Boston Type A

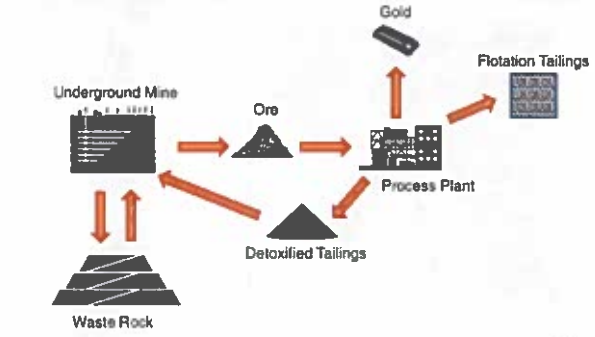
Project Certificate and Boston Type A Water Licence

- **Scope:**
- Construct and operate Boston Site
- Camp Capacity – 300 persons
- Tailings Management Area capacity of 5.1 million tonnes
  - Water Allowance:
    - Domestic from Aimaokatalok Lake 33,000m3/year
    - Industrial from Aimaokatlok Lake 450,000m3/year
- 2400 t/d process plant
- Allows water use, waste management and construction of all surface infrastructure
- **Allows commercial mining**

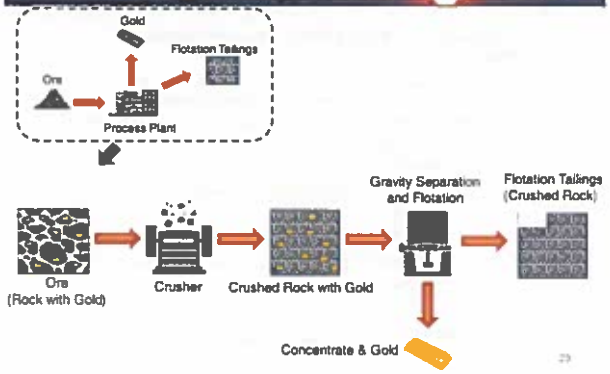
Closure and Reclamation

- Doris-Madrid Interim Closure and Reclamation Plan was updated
- Boston Conceptual Closure and Reclamation Plan was developed
- Overall objectives of closure planning at Hope Bay:
  - **Physical Stability**
  - **Chemical Stability**
  - **Future use and aesthetics**
- Planning provides basis to estimate financial security

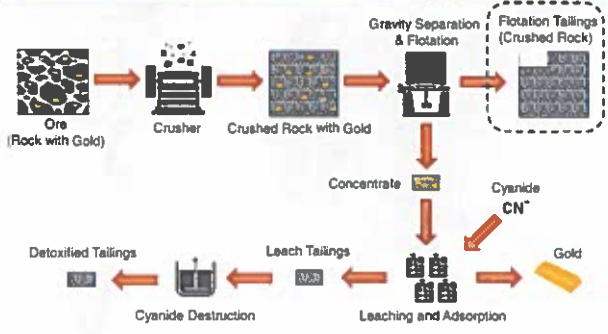
Tailings and Waste Rock



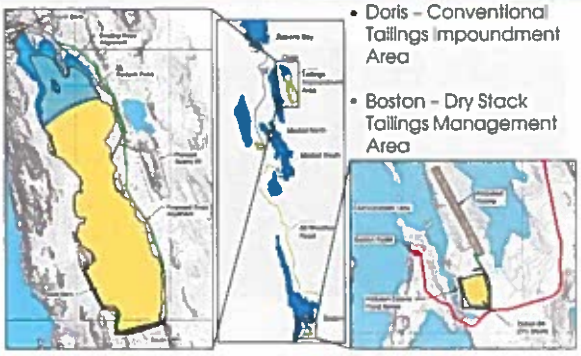
Flotation Tailings



Detoxified Leach Tailings



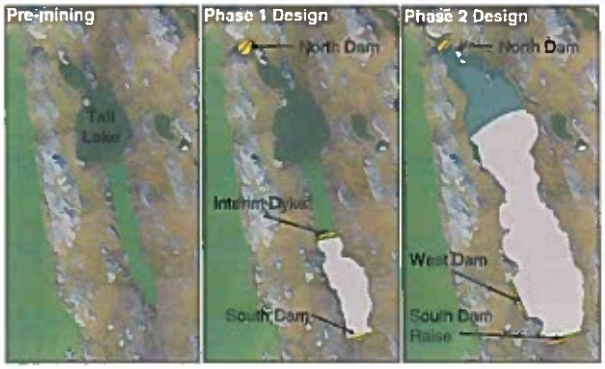
Overview of Tailings Management



- Doris – Conventional Tailings Impoundment Area
- Boston – Dry Stack Tailings Management Area

Alternative Analysis - Doris

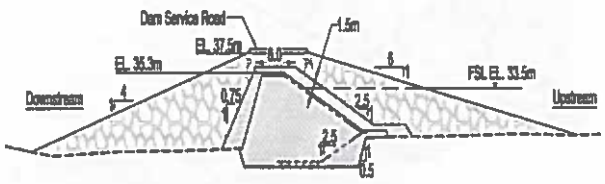
Tailings Impoundment Area - Doris



Tailings Impoundment Area - Doris

- Slurry tailings
- Low solids conten
- Pumped
- Similar to:
  - Meadowbank
  - Nanisivik

North Dam : Frozen Core Dam



- Seepage Analysis
- Stability Analysis
- Creep Analysis
- Thermal Analysis
- Settlement Analysis
- Frost Heave Assessment
- Freeboard Hydraulic Assessment

North Dam

Key Trench Excavation

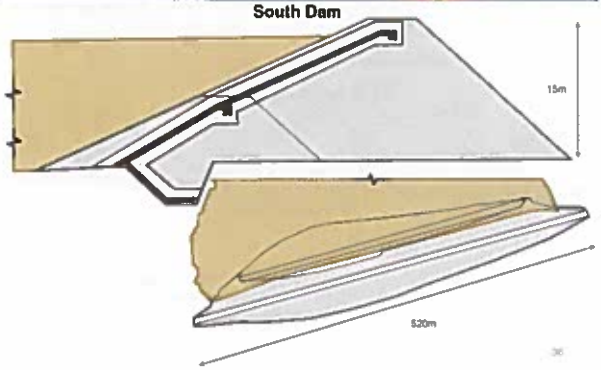
Thermosyphon Installation

Frozen Core Construction

Liner (GCL) Installation

Transition & Shell Construction

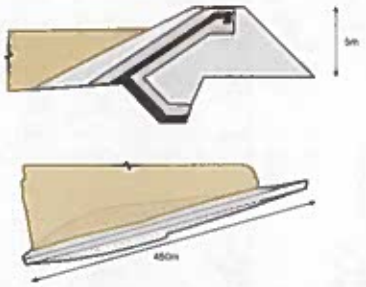
Tailings Impoundment Area - Doris



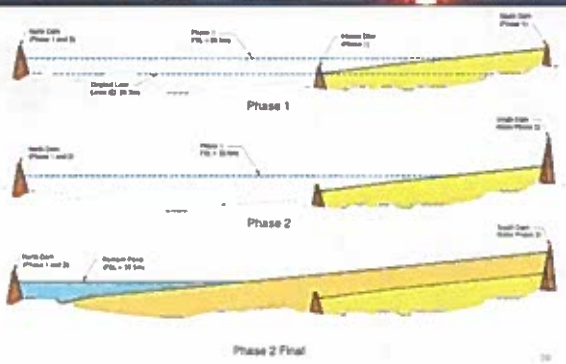
South Dam

Tailings Impoundment Area - Doris

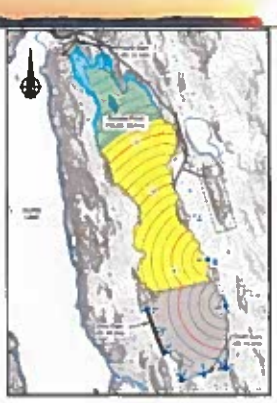
West Dam



Tailings Impoundment Area - Doris



Tailings Impoundment Area – Doris Operations



Tailings Impoundment Area - Doris

Summary of proposed changes

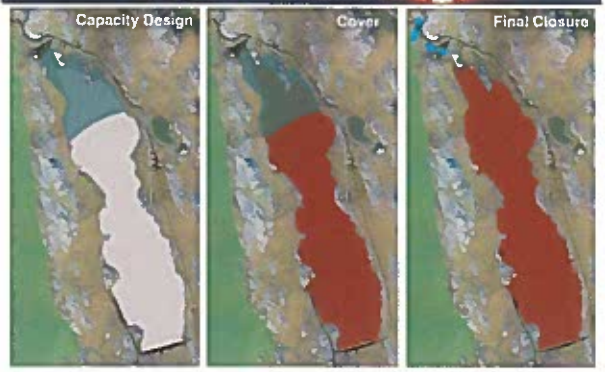
Component	Phase 1	Phase 2
Tailings Volume (tonnes)	2.5 million	Additional 15.5 million
Tailings Production Rate	Maximum nominal 2,000 tonnes per day	Maximum nominal 3,600 tonnes per day
Tailings Make-up	Only flotation tailings	No change
Deposition Method	Subaerial	No change
TIA Discharge Strategy	Seasonal discharge to Roberts Bay	No change
Closure Strategy	Breach North Dam; 0.3 m thick dry cover over tailings	No change

Tailings Impoundment Area - Doris

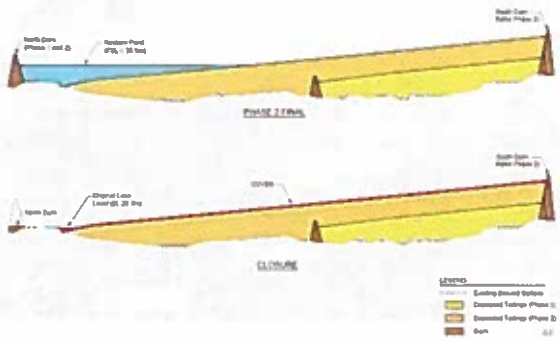
Summary of proposed changes

Component	Phase 1	Phase 2
North Dam	Frozen core dam	No change
North Dam Spillway	Includes spillway	No change
South Dam	Frozen foundation with liner	Dam raised by 8 m
Interim Dike	New containment structure	Not required
West Dam	Did not exist	Frozen foundation with liner
Tailings Geochemistry	Non acid generating; Neutral metal leaching	No change

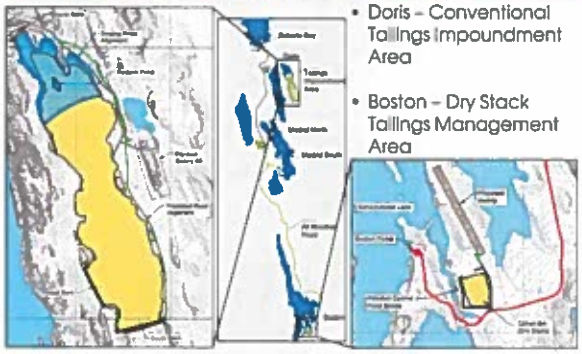
Tailings Impoundment Area - Closure



Tailings Impoundment Area - Closure

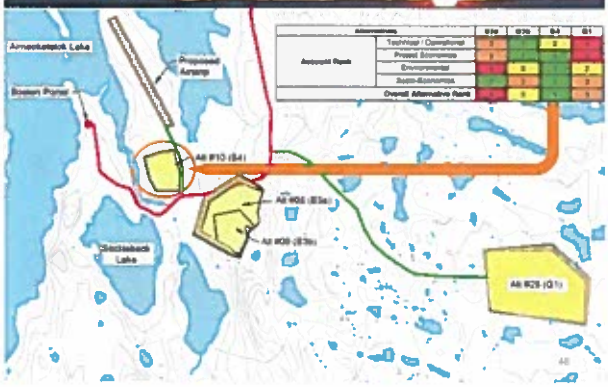


Summary of Tailings Management



- Doris – Conventional Tailings Impoundment Area
- Boston – Dry Stack Tailings Management Area

Alternative Analysis - Boston

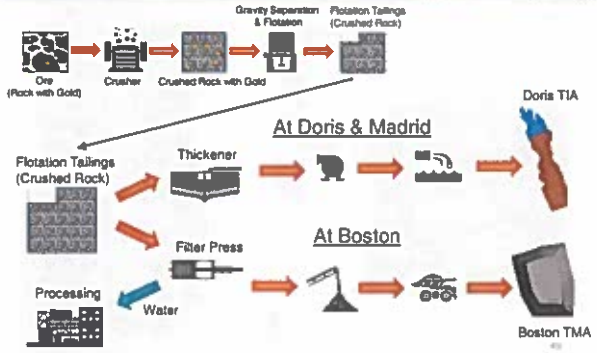


Tailings Management Area - Boston

Tailings Management Area - Boston

- Filtered tailings
- Trucks, Dozers, Compactors
- Stackable and compactable
- Similar to:
  - Raglan
  - Fort Knox
  - Pogo

Tailings



Tailings Management Area - Boston

Tailings Management Area - Boston

- Stability Analyses
- Geomembrane Leakage Assessment
- Thermal Analyses
- Deformation and Settlement Analysis

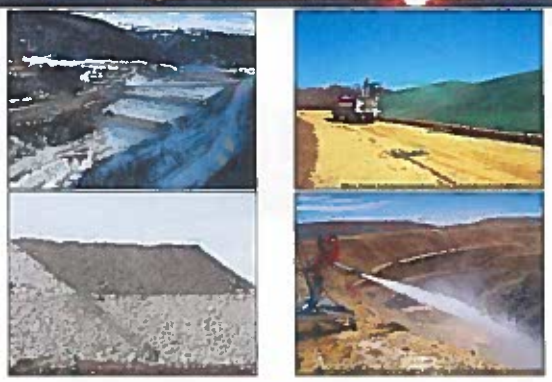
- Water collection
- Erosion Protection
- Dust Management
- Compaction and grading
- Lined Protective Cover
- Stable landform

Tailings Management Area - Boston

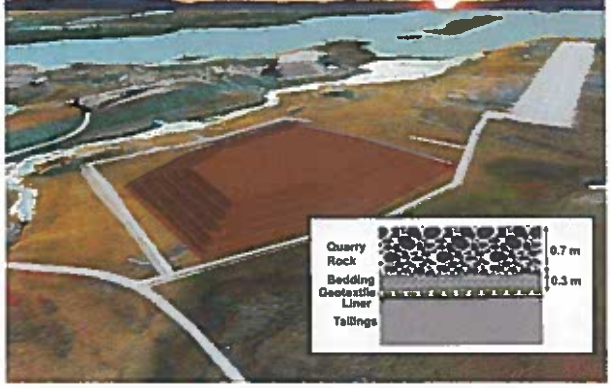
Summary of key criteria

Component	Criteria
Dam Hazard Classification	Significant
Design Life • Active deposition period • Assumed Post-closure monitoring period • Long-term design basis	 • 8 years • 10 years • Up to year 2100
Tailings Production Rate	2,400 tonnes per day
Tailing Moisture Content	20.5% (by weight)
Tailings Dry Density	1.8 t/m^3
Tailings Storage Requirement • By mass • By volume	 • 5.1 Mt • 2.8 Mm^3
Tailings Deposition Method	Load, haul, dump, place, and compact filtered tailings

Dust Management



Tailings Management Area - Boston Closure

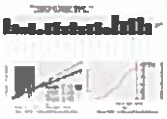


Tailings Facility Designs

Additional geotechnical investigation and detailed design prior to construction



Consider Climate Change



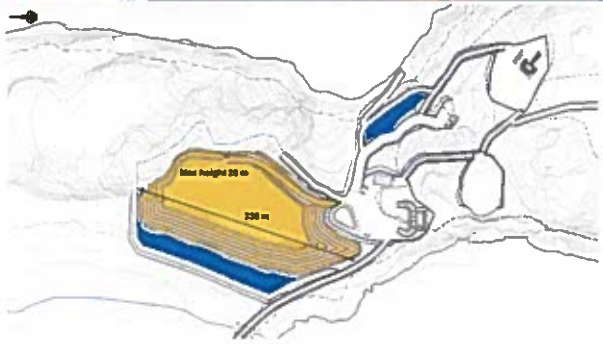
Summary of Waste Rock Management

Temporary Waste Rock Piles

Summary of Waste Rock Management

Madrid North

Summary of Waste Rock Management



Madrid South

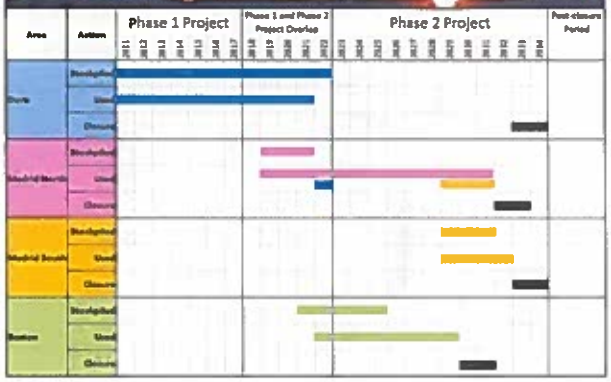
Summary of Waste Rock Management

Boston

Summary of Waste Rock Management

- Stability Analyses

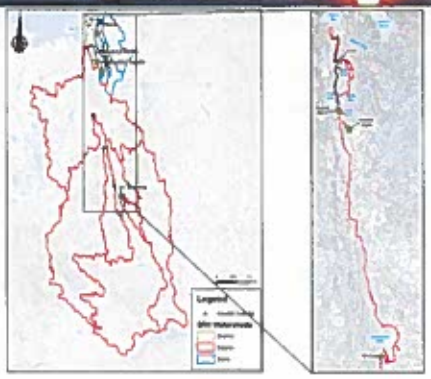
Summary of Waste Rock Management



Tailings and Waste Rock Management

- State of practice tailings management
  - Doris Tailings Impoundment Area
  - Boston Tailings Management Area
- No waste rock left on surface post closure

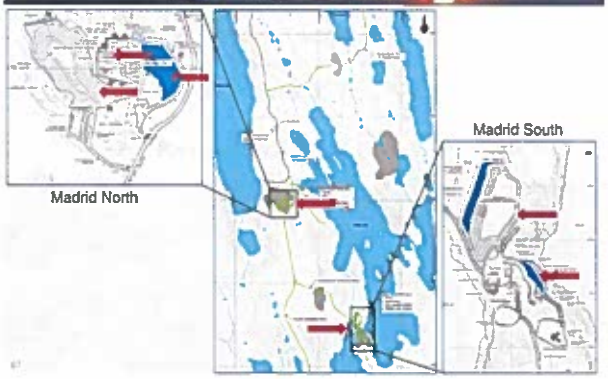
Hydrological Setting



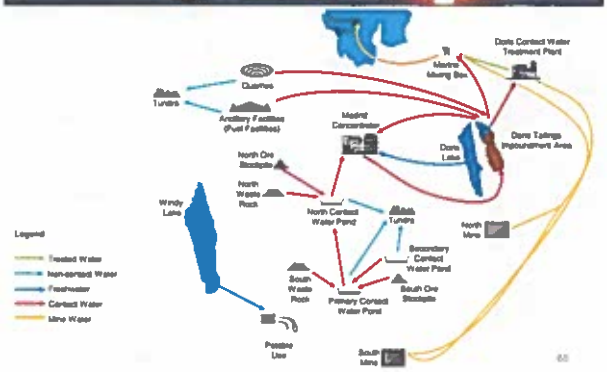
Doris Water Management

Doris Water Management

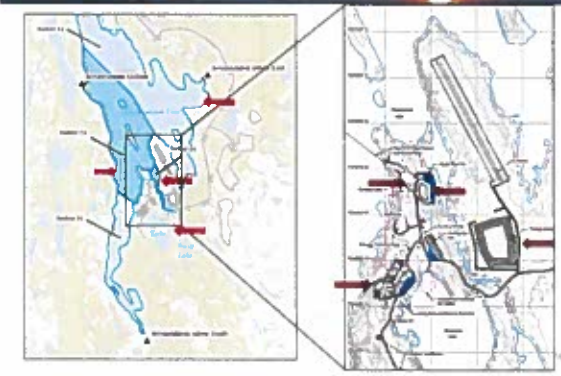
Madrid Site Layout



Madrid Water Management



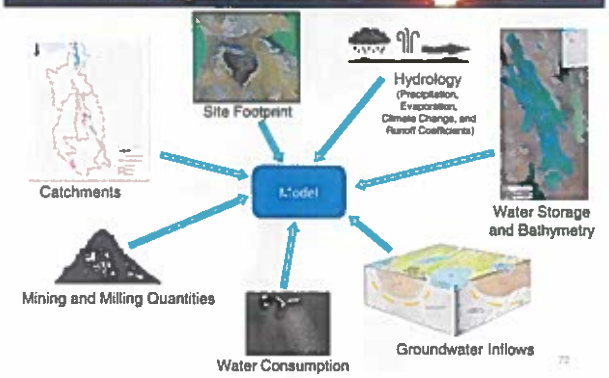
Boston Site Layout and Aimaokatalok Lake



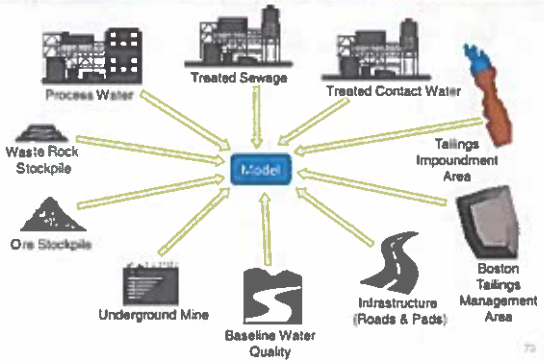
Boston Water Management

- Modelling Approach and Methods

Model Inputs – Quantity



Model Inputs – Quality



- Model Results

Doris/Madrid Water Use

Water Demand	Lake Withdrawal (m³/day)	
	Doris	Windy
Doris Process Plant	880	-
Madrid Concentrator	110	-
Doris Camp Potable	-	120
Doris/Madrid General Use	1,470	-
Total Phase 2	**2,460**	**120**
Increase from Phase 1	1,340	57

Boston Water Use

Water Demand	Amookatalok Lake Withdrawal (m³/day)
Boston Process Plant	550
Boston Camp Potable	90
Boston General Use	1,000
Total Phase 2	**1,600**

Freshwater Environment

- **Madrid-Boston Phase 2**
  - Valued Ecosystem Components:
    - Surface Hydrology
    - Surface Water Quality
    - Sediment Quality
    - Fish
      - Fish Community
      - Fish Habitat

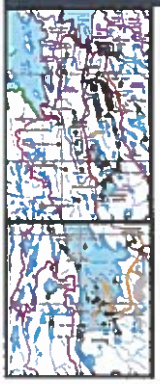
➢ No Significant Residual Effects of Project on Freshwater Environment

Freshwater Environment – Monitoring

Potential effects on the Freshwater Environment will be monitored:

- Aquatic Effect Monitoring Program
- Environmental Effects Monitoring under the Metal and Diamond Mining Effluent Regulations
- Surveillance Network Program under applicable Type A water licences
- *Fisheries Act* Authorizations and Offsetting

Baseline and Existing Environment



- **Freshwater data has been collected in Hope Bay Belt since 1993**
  - Project lakes and streams
  - Reference lakes and streams
- **Freshwater lake and stream data includes:**
  - Hydrology (streams) and lake levels
  - Water quality (winter and summer)
  - Sediment quality (summer)
  - Primary producers
  - Secondary producers
  - Fish and fish habitat, including tissue metals

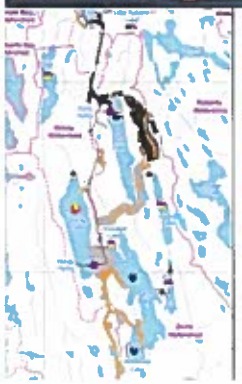
Aquatic Effects Monitoring Program

Aquatic Effects Monitoring Program evaluates potential aquatic effects from point (treated discharge) and non-point (runoff, dust) Project sources following mitigation.

Refinements from Intervenor Comments:

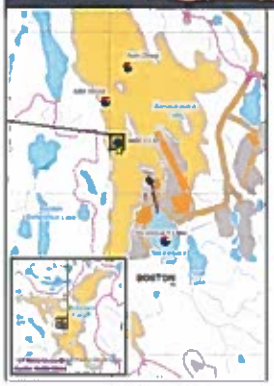
- Belt-wide program (Doris, Madrid, and Boston areas)
- Aquatic Response Framework
- Enhanced harmonization of program with federal Metal and Diamond Effluent Regulations
- Inclusion of water level and stream flow data (Fisheries Offsetting)
- Windy Lake sampling
- Additional cyanide analyses

Aquatic Effects Monitoring Program North Belt (Doris and Madrid)



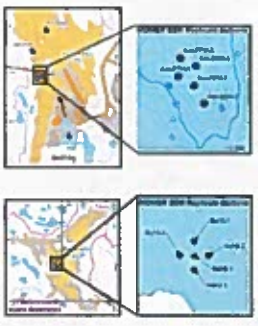
- **Non-point sources**
  - water withdrawal and inflows
  - runoff and dust
- **Doris, Patch, Windy, Wolverine Lakes**
  - water level
  - water and sediment quality
  - biology
- **Ogama, P.O., Glenn, Little Roberts**
  - water level

Aquatic Effects Monitoring Program South Belt (Boston)



- **Aimaokatalok Lake**
  - Point source (treated discharge)
  - Non-point source (runoff, dust)
  - 2 Program sites
  - 1 Federal Effluent Regulation site
- **Stickleback Lake**
  - Non-point source (runoff, dust)
  - 1 Program site
- **Reference Lake B**
  - 1 Program/ Federal Effluent Regulation site

Metal and Diamond Mining Effluent Regulations Monitoring Program



- **Discharge of treated water to Aimaokatalok Lake**
- **Requirement under *Fisheries Act***
  - Water, sediment, benthic invertebrates, fish
  - Before-After-Impact-Control Design (BACI)
  - Sites based on hydrodynamic modelling

Fisheries Act Authorizations

Authorizations required for all project activities resulting in loss of fish habitat/productivity

- Water withdrawal from streams/lakes
- Stream culvert crossings
- Footprint of pipe/intakes on lake bottom

Existing Authorizations and monitoring for Doris Mine

- Tail Lake Outflow
- Roberts Bay Jetty

Anticipated Authorizations for Madrid-Boston

- Authorizations need to be in place prior to any loss in fish habitat or productivity from Project
- Currently under development with Fish Offsetting plan

Fisheries Offsetting Program

Offsetting required to balance all loss of fish habitat/productivity

- Workshop with Inuit Environmental Advisory Committee attended by Fisheries and Oceans Canada
- Development considers comments from KIA, Nunavut boards, and Federal Family
  - adaptive management processes
  - lake water levels and stream flows
  - ground-truth offsetting site options
- Include mine site and offsite community based-fish productivity enhancements
- Baseline work to support offsetting in 2018
- TMAC will continue to work with Inuit and other Interested Parties through Offsetting process

Fisheries Monitoring

Fisheries monitoring under:

- Metal and Diamond Mining Effluent Regulations
- *Fisheries Act* Authorizations
- Fisheries Offsetting program
- Other programs (e.g., stream crossing construction monitoring plan, Commitment DFO-3.1.1)

Summary

TMAC has put extensive effort to understand and mitigate potential effects to the freshwater environment related to the Hope Bay Project, including:

- Comprehensive baseline characterization
- Predictive water quality, quantity, and effluent dispersion modelling
- Development of comprehensive monitoring programs
- Consultation with Inuit Communities, Kitikmeot Inuit Association, and Federal Family, including consideration of technical comments and recommendations
- Future workshop with the Inuit Environmental Advisory Committee

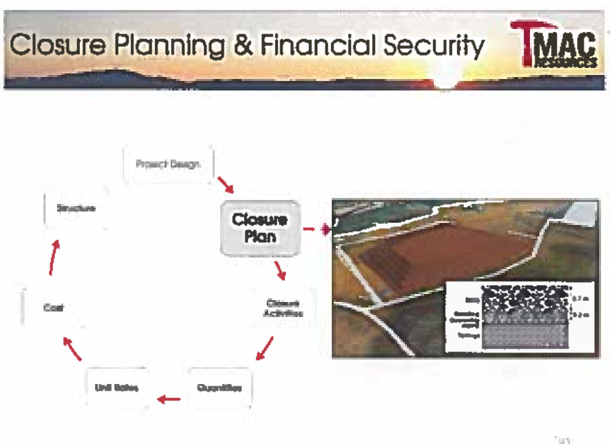
TMAC is committed to working cooperatively with Inuit, Nunavut Boards, and the Federal Family through the water licencing process to ensure its activities in the Hope Bay Belt are protective of the Freshwater Environment. Future workshop with the Inuit Environmental Advisory Committee.

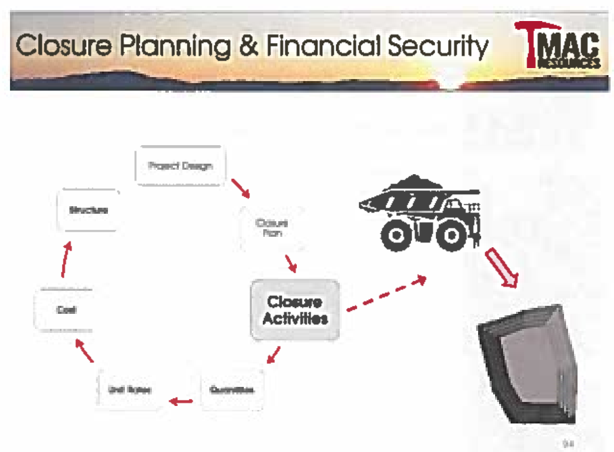
Closure Planning & Financial Security

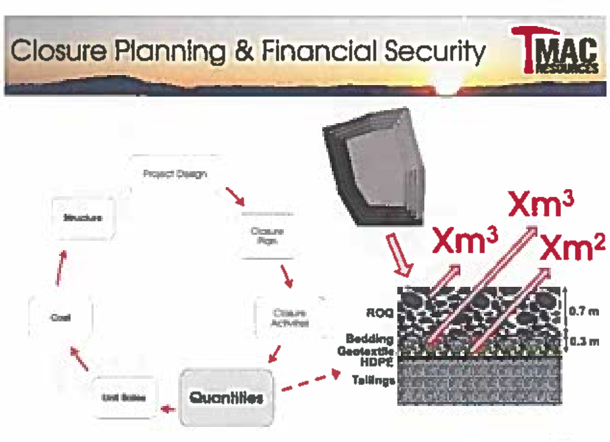
1. Closure Planning
2. Financial Security Estimate Process
3. Phase 1 Obligations
4. Phase 2 Outcomes


Closure Planning & Financial Security
TMAC RESOURCES
How we develop a security bond
Project Design
Closure Plan
Closure Activities
Quantities
Unit Rates
Cost
Structure


Closure Planning & Financial Security
TMAC RESOURCES
Project Design

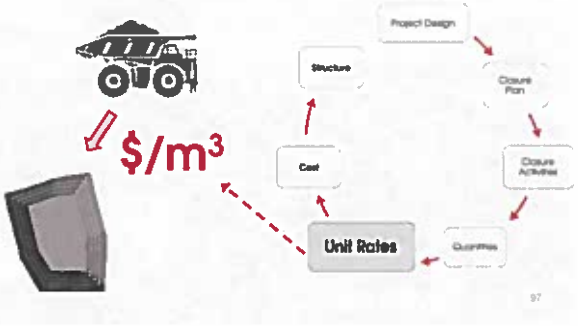

Closure Planning & Financial Security
TMAC RESOURCES
Project Design
Closure Plan


Closure Planning & Financial Security
TMAC RESOURCES
Project Design
Closure Activities


Closure Planning & Financial Security
TMAC RESOURCES
Project Design
Quantities
Xm3
Xm3
Xm2
ROQ
Bedding
Geotextile
HDPE
Tailings
0.7 m
0.3 m


Closure Planning & Financial Security
TMAC RESOURCES
Project Design
Quantities
$/m3

Closure Planning & Financial Security



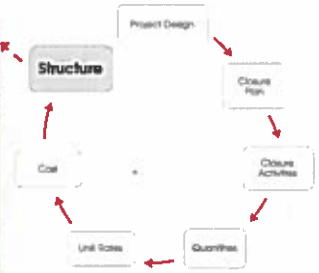
Closure Planning & Financial Security

$/m³ x Xm³ = $
+
$/m³ x Xm³ = $
+
$/m³ x Xm³ = $
+
Indirect = $

Total Quantum = $

Closure Planning & Financial Security

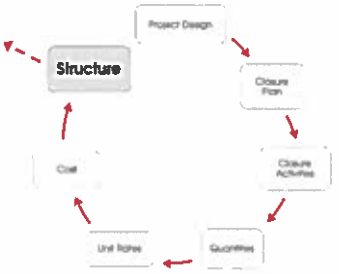
Land and Water Split



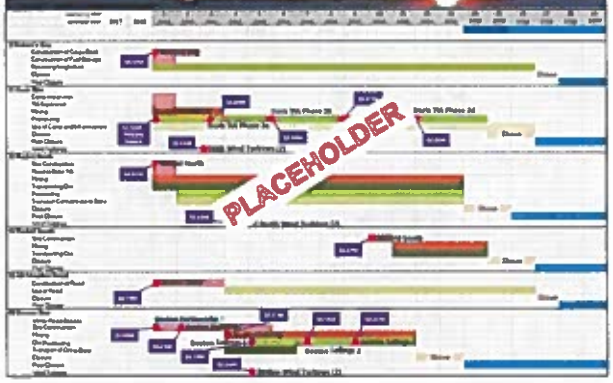
Closure Planning & Financial Security

Staging

Trigger 1 (Milestone 1)	●	Tranche 1 ($ Amount 1)
Trigger 2 (Milestone 2)	●	Tranche 2 ($ Amount 2)
Trigger 3 (Milestone 3)	●	Tranche 3 ($ Amount 3)



Closure Planning & Financial Security



Closure Planning & Financial Security

Phase 1 Security Postings

KIA (under Framework Agreement)
- $17.6M - Type "A" WL / Commercial Lease
- $2.0M - Overbonding
- $0.8M - Advanced Exploration
- $0.1M - Land Use Permit

CIRNAC / Receiver General of Canada
- $13.1M - Type "A" WL (Doris)
- $3.6M- Type "B" WL (Boston)
- $0.5M - Marine Outfall Lease
- $0.08M - Jetty Lease

Fisheries and Oceans Canada
- $0.07M - Fisheries Act Authorization

TOTAL: $37.9M

Same process for Phase 1

Closure Planning & Financial Security

- Outcomes for Phase 2

Environmental Management System

- TMAC has a functioning environmental health and safety management system for our existing operations
- Inherent in the management system is reporting, adaptive management and continual improvement with input from stakeholders

Key Aims of EMS:

- Identify environmental science, Project Certificate, EIA and regulatory requirements
- Environmental protection measures to avoid or minimize environmental impacts
- Incorporate Inuit Participation and knowledge
- To establish monitoring programs
- Monitor and Report
- Ensure employee awareness
- Adapt monitoring and analysis as required in consultation with parties

Management Plan Overview

Biophysical Management Plans

1. Surface Emergency Response Plan
2. Underground Emergency Response Plan
3. Oil Pollution Prevention Plan (OPPP)/Oil Pollution Emergency Plan (OPEP)
4. Doris Project Domestic Wastewater Treatment Management Plan
5. Boston Sewage Treatment Operations and Maintenance Management Plan
6. Groundwater Management Plan
7. Doris-Madrid Water Management Plan
8. Boston Water Management Plan
9. Water and Ore/Waste Rock Management Plan
10. Boston Sewage Treatment Operation and Maintenance Plan
11. Quarry Management & Monitoring Plan
12. Explosives Management Plan
13. Air Quality Management Plan
14. Noise Abatement Management Plan
15. Doris Aquatic Effects Monitoring Plan
16. Wildlife Mitigation and Monitoring Plan
17. Madrid Tailings Impoundment Area Operations, Maintenance, and Surveillance Manual
18. Boston Tailings Management Area Operations, Maintenance, and Surveillance
19. Waste Rock and Ore Management Plan
20. Non-Hazardous Waste Management Plan
21. Hydrocarbon Contaminated Material Management Plan
22. Spill Contingency Plan
23. Hazardous Waste Management Plan
24. Incinerator Management Plan

Environmental Protection Plan

Socioeconomic Management Plans

1. Health and Safety Management Plan
2. Community Involvement Plan
3. Heritage Resource Protection Plan
4. Human Resources Plan

Closure and Reclamation Plans

1. Doris-Madrid Interim Closure and Reclamation Plan
2. Doris-Madrid Interim Closure and Reclamation Detailed Cost Estimate
3. Boston Conceptual Closure and Reclamation Plan
4. Boston Conceptual Closure and Reclamation Plan, Detailed Cost Estimate

Final Written Submissions

- TMAC received 11 final written submissions that required a response:

Party / Comment ID	Topic	Status
CIRNAC-1	Scope and transition approach of Type A and Type B Licences	Resolved
CIRNAC-2	Term/duration of amended or new Type A Water Licence(s)	Resolved
CIRNAC-3	Water use quantities	Resolved
CIRNAC-4	Water management approach	Resolved
CIRNAC-5	Waste management approach	Resolved
CIRNAC-6	Management Plans and reports	Resolved
CIRNAC-7	Aquatic Effects Monitoring Plan	Resolved
CIRNAC-8	Closure planning and financial security	Partially Resolved
ECCC-WL-1	Aquatic Effects Monitoring Plan	Resolved
ECCC-WL-2	Effluent quality criteria	Resolved
ECCC-WL-3	Mitigation and monitoring of in-water construction activities	Resolved

Thank You, Questions?