# WHALE TAIL PIT THE FUTURE OF THE MEADOWBANK MINE



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# PART IX - FRESHWATER ENVIRONMENT

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# FRESHWATER ENVIRONMENT – PRESENTATION OVERVIEW ΔL¹∩ϤͺCdς°ċͺჼ•∩¹∩σ·ʹΓ•ΛʹϞͺ∩ϲ-ϧ



#### **Freshwater Environment**

- Description of VCs and Inuit concerns related to Freshwater Environment
- Water Management
- Contact and Non- Contact Water Management
  - Describe surface hydrology
  - Designs for Water Management Infrastructure (iv.)
  - Alternatives assessment/ Multiple Accounts Analysis for Water Management
- ii. Hydrogeology (Talik within Whale Tail Open Pit)
- Summary of the FEIS results
- Fisheries Offsetting
- iii. Adaptive Management

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### WHALE TAIL PIT DOCUMENT MAP

### WHALE TAIL $\Delta C C \Delta^{3}C C \Delta^{5}C C C \Delta^{5}C C \Delta^{5}C C C \Delta^{5}$



Volume 1 -Introduction Binder Project Description Appendix 1-47 Cover Letter Agnico Eagle Financial Statement Appendix 1-0: Attachment A: NIPS Part 1 and Part 2 List of Fermits, Licenses Application Forme and Authorizations Appendix 1-0: Decign Drawings N/NB Application Form Conceptual Layouts Appendix 5-0: Scoping Level Open Pit NPC Conformity Letter Slope Design Attachment D: Appendix 1-E: Non-technical Summary Multiple Account Analysis Attachment & Executive Summaries

Volume 2 -**Environment Overview** Type A Water Licence Appendix 2-40 Record of Compliance to the Project Certification Appendix 2-8: Nunerut Impact Review Board Conformity Appendix 2-0; Regulatory History Appendix 2-0: Base ine Data Collection Reports Appendix 2-E: Closeery Appendix Diff: Table of Contents for Project. Appendix 2-Q Consultation Records Appendix 540 **Application Forms** Appendix 2-t Numerut Water Board Conformity Appendix 2th Project Design Considerations Appendix 240 Record of Compliance to Water Doence

Whale Tail - NIRB Project Certificate and NWB Type A Water Licence Amendments

Volume 4 -Volume 3 -Atmospheric Assessment Methods Environment Appendix 3-4: Appendix 4-x Marine Environment Air Quality Baseline Summery Appendix 3-0: Human Health and Appendix 4-8: Ecological Flex Air Emissions Inventory Assessment Summary Appendix 3-0: Appendix 4-0: Pathway Analysis and Air Quality Modelling Linkage Matrix Tables Technical Summary Appendix 3-D: Cumulative Effects & Appendix 4-0: Regognably Foreseeable Noise Baseline Report **Future Development** Appendix 3-E Appendix 4-E: Residual Impart Noise and Vibration Opportunitions Definitions Impact Assessment

Volume 5 -Terrestrial Environment Appendix 5-4: Tempin, Permatrost, and Solie Baseline Report Appendix 5-8: Total Soil Metal Concentrations Appendix 5-0: Terrectrial Baseline Characterization Report Appendix 5-0: Tables of Collared Caribos Residency and Road Cross ng Appendix 5-6: Geochemistry Baseline Report

Volume 7 -Freshwater Human Environment Environment Appendix 7-4: Appendix 8-4: drogeology Baselin inuit Quijimajetugengit Report Baseline Report Appendix 8-8: Appendix 7-8: Hydrodeological Model Pre-Socio-economic Baseline Mining, During Mining and Report Cloqure Appendix 6-0: Hydrology Baseline Report Appendix 9-0: Fish 2015 Road Baseline Report Appendix 8-6 Supporting Evidence of the Hydrology Effects Assessment Appendix 6-F Flooding During Phones Appendix 8-G: Whale Tall Pit CREMP 2014-2015 Baseline 35,d ee Appendix 846 Mine Dite and Receiving Environment Water Quality Predictions Appendix 6-b Water Quality Prediction Summary Tables Appendix 6-): Fish 2014 Reseline Road Report Appendix 840 Fish 2015 Whale Tel: Pit Saseine Report Appendix & L. Figh Capture Date Appendix @At: 2015 Specine Bathymetry Appendix 8-ht Site-specific Water Quality Objective - Arsenic

AGNICO EAGLE Volume 8 -Mitigation, Monitoring, and Management Plans Appendix 8.4.5 Mills Waste Rock and Tailings **Wanagement Plan** Appendix B-A-2: WO Monitorina A Management Plan for Dile Construction Devestoring Appendix 6.8.1. Landfill Design and Management Plan. Appendix 9-9-2: Water Management Plan Accends 6-8.3: Water Quality and Flow Monitoring Plan. Appendix & C.S. Whate Tail Pri Hauf Road Management Plan Appendix 8.D.S. Ammenia Management Plan Appendix 6-0-2, MBK Bulk Fuel Storage Facility Environmenta Performance Monitoring Plan Appendix 8-0.5 Emergency Response Plan Appendix 8.D.4: Haberdous Materials Management Fran Appendix 8-0.5 Shipping Management Plan Appendix 8-D it: Spill Contingency Flan Appendix S-E.1: Air Quality Monitoring Plan

> Appendix 8-E.2: Core Receiving **Environment Manituring**

Program

Appendix 8.E.S. Groundwater

Whale Tall Pit Offsetting Plan

Appendix B-E.S: Operational

ARC/ML Sampling and Testing Appendix 6-E 6 Socio-

Monitoring Plan Appendix 8-5.7. Terrestrial Ecosystem Management Plan

Appendix S-E.B. Archaeology Management Pron

Appendix 8-F.1, Intertin Whale

Tall CAR Plan

Appendix 0-0; FMMS Stander

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Monitoring Program Appendix B-E-4: Conseptual





- Valued Components and other components assessed:
  - Hydrogeology
  - Groundwater quality and quantity,
  - Surface Water Quality,
  - Water Quality,
  - Sediment Quality,
  - Arctic Grayling, Arctic Char, Lake Trout, Round Whitefish

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### FRESHWATER ENVIRONMENT △L¹∩⊲≪⁰





#### Inuit Concerns:

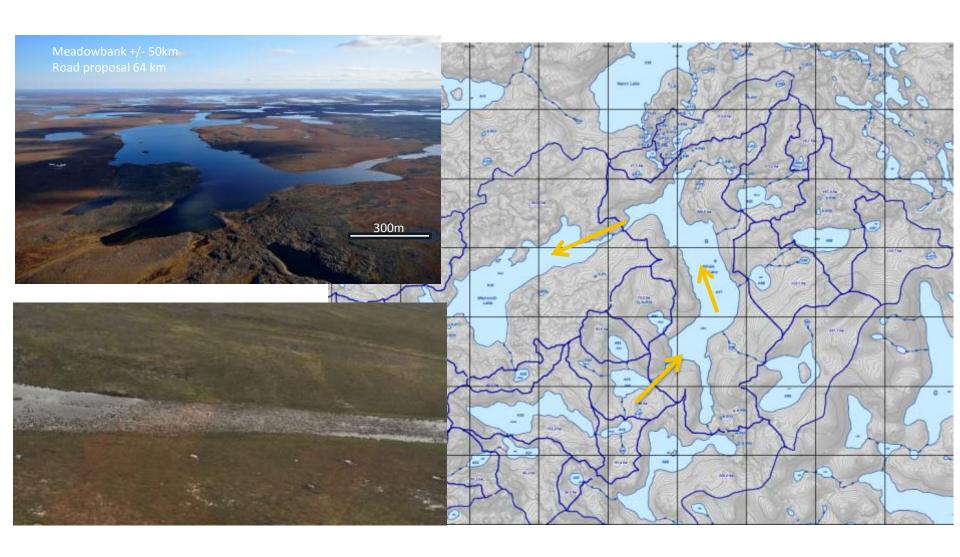
- importance of rivers and lakes as travel routes during the winter;
- fish are an important secondary source of traditional food;
- traditionally fishing did not take place within the project lakes area; and
- concerns of effects of mining on water quality (e.g. spills, dust, disturbance to lakes and dewatering).

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### **Surface Water Management**

Volume 8- Appendix 8-B.2 – Water Management Plan

Objective: to minimize the potential impact of the project on the receiving water surrounding the proposed mining activities

### Strategies:

- Reduce the amount of contact water requiring management, pumping, monitoring and treatment
- Divert non-contact water away from the mine site
- 3. Limit freshwater quantity requirements

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### Surface Water Management

#### Contact water:

- Water that has come into contact with mine site processes or reports from disturbed catchment areas
- All contact water intercepted, contained, analyzed and re-used in mine operations or treated and released once discharge criteria are met

#### Non contact water:

- Water originating from areas unaffected by mining activity (undisturbed catchments)
- Non- contact water is intercepted and/or directed away from mining areas by means of natural or constructed diversions (such as frozen saddledams, roads or channels)

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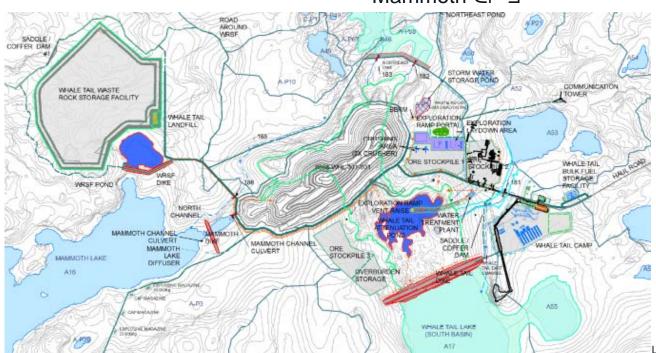
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# WHALE TAIL PIT - WATER MANAGEMENT WHALE TAIL DO COSOLLES ALS COSOLLES



- Separate contact water from noncontact water
- Contact water is directed to Whale Tail Attenuation Pond
- Pit sumps, Waste Rock Storage Facility Pond
- Treated Effluent is discharged to Mammoth Lake

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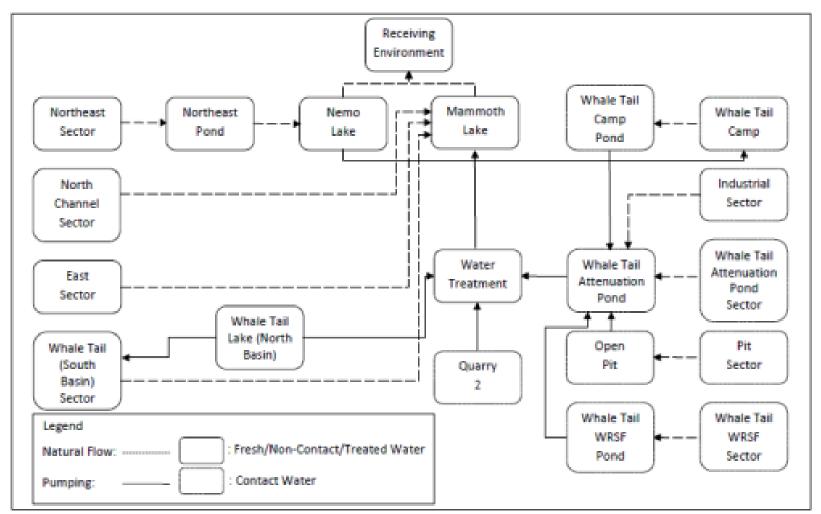


Figure B.1 Water Management Flowsheet during Construction and Operations

### WHALE TAIL PIT - WATER MANAGEMENT - SADDLEDAM DESIGN

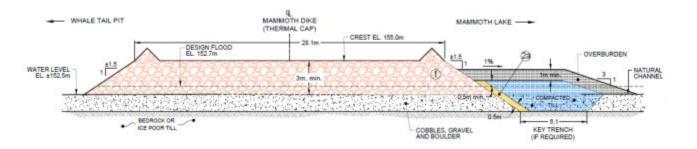


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Mammoth Dike is similar in design to South Camp and Vault Dike



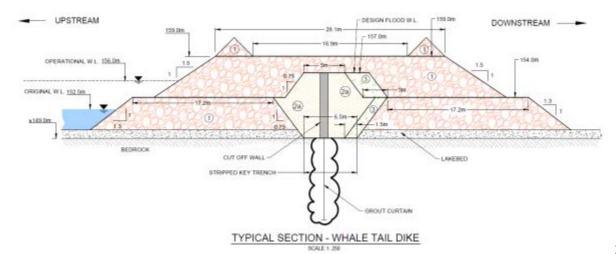
### WHALE TAIL PIT – WATER MANAGEMENT - DIKE DESIGN



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- Whale Tail Dike is similar in design as East Dike and Bay Goose Dike at Meadowbank
- Whale Tail-Γ<sup>c</sup> ΔL<sup>q</sup> ω<sup>c</sup> b ∩ <sup>qb</sup> c<sup>l</sup> Δ<sup>q</sup> δ<sup>c</sup>  $\Delta L^{\varsigma} \sigma^{-b} b \cap^{\varsigma b} c' \Delta^{\varsigma} \dot{\Delta}^{c} \Delta^{L} L \rightarrow Bay Goose-\Gamma^{c}$ √>560° 0 560 FC



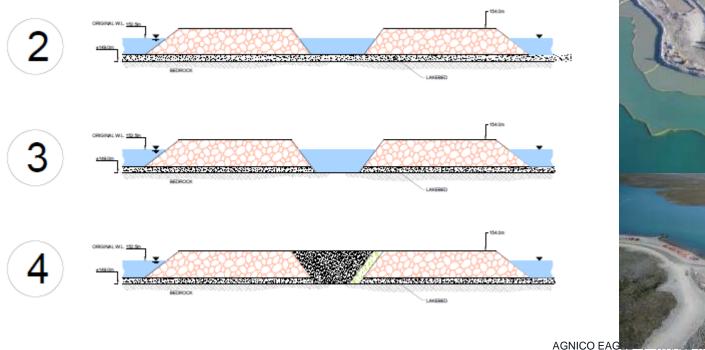


### WHALE TAIL PIT – WATER MANAGEMENT - DIKE CONSTRUCTION

WHALE TAIL  $\Delta \Delta \Gamma^c \Delta \Delta^c \Omega^{ch} \wedge \Delta L^{ch} \wedge \Delta L^{ch}$ 

- Step 1: Install turbidity curtains and begin monitoring (lake elevation 152.5 masl)
- Step 2: Begin platform construction to elevation 154 masl.
- Step 3: Excavate lake bottom till down to bed rock
- → Step 4: Fill cut-off with gravel

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### WHALE TAIL PIT – WATER MANAGEMENT - DIKE CONSTRUCTION

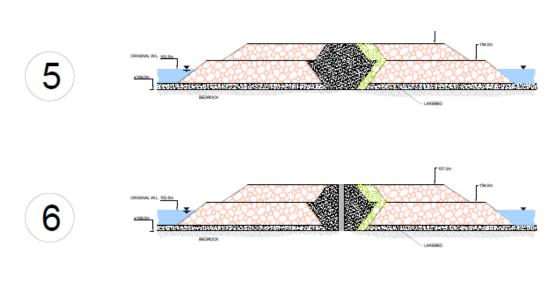
WHALE TAIL  $\Delta \Delta \Gamma^c \Delta \Delta^c \Omega^{cr} \wedge \Delta L^{r} \Gamma^b \wedge \Delta L^{r}$ 

- Continuously assess the need of additional turbidity curtains along the face of the dike or alternative construction mitigation
- Step 5: place final lift of dike platform material to elevation 157 masl
- Step 6: begin completion of the bentonite cut-off

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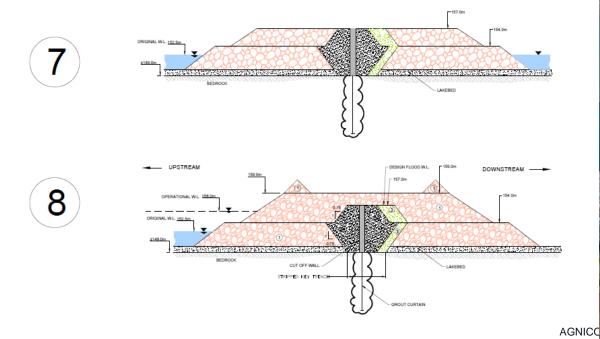
### WHALE TAIL PIT – WATER MANAGEMENT - DIKE CONSTRUCTION

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- Step 7: Complete grout curtain within the key trench
- Step 8: Dike construction completion
- Dewatering of Whale Tail Lake North will begin
- Operational Maintenance and Surveillance of the Dike

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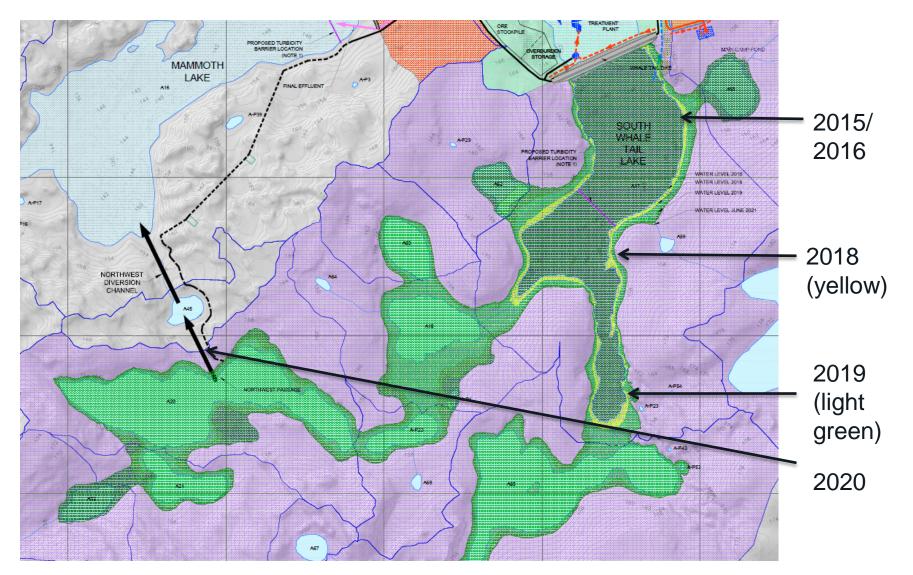


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# WATER MANAGEMENT - WHALE TAIL LAKE (SOUTH BASIN) FLOODING AND WATER DIVERSION

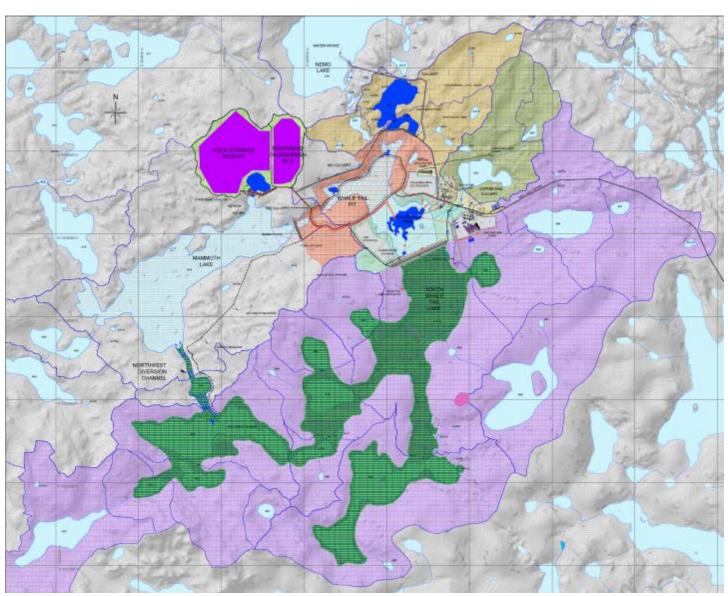


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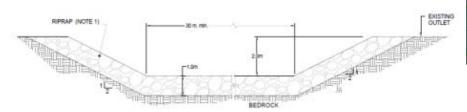
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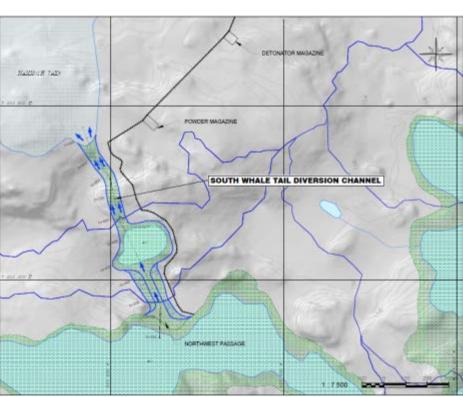






- Connects Lake A20 to pond A45
- 7 Simple channel design with 2:1 slope
- **7** Excavated and armored
- Similar to other diversion channels constructed at Meadowbank
- **7** bハーンの Cパッ A20 Cパット A45-J<sup>c</sup>
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SOUTH WHALE TAIL DIVERSION CHANNEL - PLAN VIEW

#### TYPICAL SECTION - SOUTH WHALE TAIL DIVERSION CHANNEL

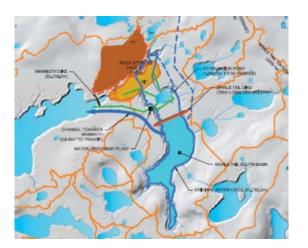


# WATER MANAGEMENT - MULTIPLE ACCOUNTS ANALYSIS ΔL¹σቴ ላ▷፫፡ናበσቴ - ፕቴሩ/ፈናረσቴ ቴኮኦ/አΔጵ፡ና

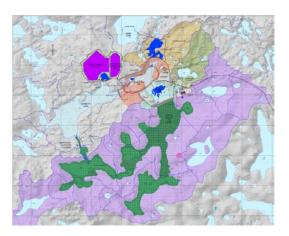


- Option 1 Pumping To Mammoth Lake (east basin)
- Option 2 Channel from Whale Tail Lake to Mammoth Lake (east basin)
- Option 3 Rerouting water towards
   Mammoth Lake (larger area to be flooded)
- 4. Option 4 Channel and re-routing water towards Mammoth Lake (preferred option)

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   Mammoth Cィ」<sup>1</sup> (ba<sup>5</sup>a<sup>5</sup>log<sup>7</sup>)
- 2. <ファクトイプロット 2: イベリン Whale Tail Cイバアベ Mammoth Cイバゴ( (baプaプレロバ)
- ΔϽ<sup>ና</sup><sup>6</sup>CDປ<sup>6</sup><sup>6</sup>Δ<sup>6</sup>D<sup>6</sup>
   Mammoth CປD
   Γ<sup>6</sup><sup>6</sup>LD
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Option 1 and 2

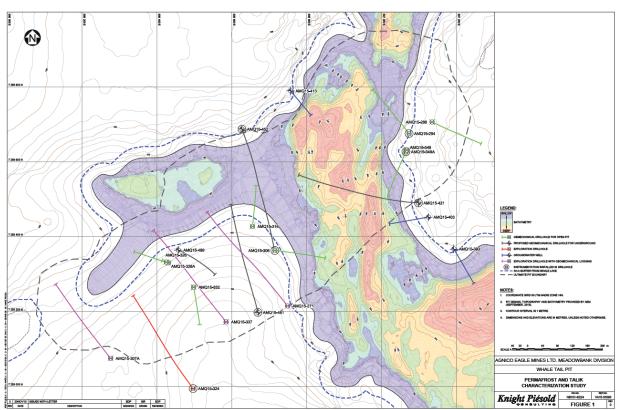
Option 3

Option 4

# WHALE TAIL PIT WATER MANAGEMENT - HYDROGEOLOGY WHALE TAIL ΔΩΓ'ΔΔ'Ο' Δ'L Κ' ΔL'Γ' ΔΡα ΛΙ Γ' ΔLα ΛΙ Γ' ΔLα ΛΙ Γ' ΔΙ Γ' ΔΙ



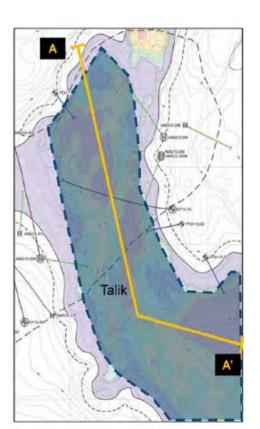
- Baseline conditions are characterized in Appendix 6-A – Hydrogeology Baseline Report
- 2015 –installed 3 GW Wells
- 2016 installed a multi port Westbay GW Well
- $\nearrow$  2015- $\Gamma^{c}$   $\Delta$   $\subset$   $\ell^{c}$   $\wedge$   $^{c}$   $\ell^{c}$   $\otimes$   $\Delta$   $\ell^{c}$   $\otimes$   $\ell^{c}$



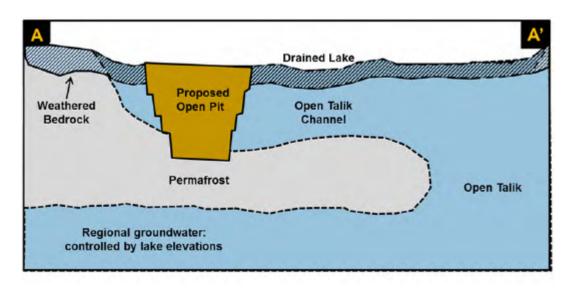
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- Permafrost is expected below land and in shallow areas of Whale Tail Lake
- Talik is underlain by permafrost near the pit
- Open talik towards the central portion or deeper section of Whale Tail Lake



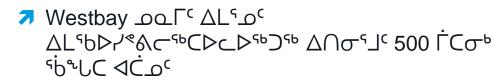
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- → PPQVPLAC APC APC APCPAPDC 500540cc VUC.pc Mhale Tail CYD<



# WHALE TAIL PIT WATER MANAGEMENT - HYDROGEOLOGY WHALE TAIL ΔΩΓ'ΔΔ'Ο' Δ'L Κ' ΔL'Γ' ΔΡα Λαινοί ΔLαινοί Δ



- Westbay groundwater well installed to a depth of 500m below surface
- Ports are positioned at different intervals:
  For example:
  - Port 1 488.3 to 499 m
  - Port 3 381.5 to 392.3 m
  - Port 6 276.2 to 286.9 m
- Data from 2016 are reliable and are consistent with FEIS predictions



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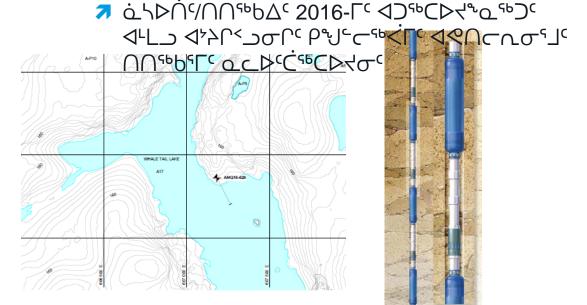
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- つこ<sup>6</sup>C<sup>6</sup>A<sup>6</sup> 2 381.5-C<sup>6</sup> 392.3 C-J<sup>6</sup>
- ⊃ς<sup>6</sup>C<sup>6</sup>δ<sup>6</sup> 3 276.2-Γ<sup>6</sup> 286.9 Γ˙C-J<sup>6</sup>

Upper 180-ft.
Aquifer
Intermediate
180-ft. Aquitard

Lower 180-ft.
Aquifer

400-ft. Aquifer



# FEIS SUMMARY – HYDROGEOLOGY AND WATER QUANTITY PUCCECTO ACCOMPTION ALES SUMMARY – HYDROGEOLOGY AND WATER QUANTITY ALES SUMMARY – HYDROGEOLOGY AND WATER QUANTITY



### **Summary of Results**

Volume 6 – Freshwater Environment

- Hydrogeology and Groundwater
  - Pit operations will remain within the permafrost and no primary pathways were identified
- Surface Water Quantity
  - Dewatering, mine infrastructure development and diversion activities of the Project will alter surface water quantity
  - Dewatering of Whale Tail Lake (North Basin) and flooding of Whale Tail Lake (South Basin) and diverting water to Mammoth through the diversion channel will alter the water levels, flow and channel/bank stability

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### FEIS SUMMARY – WATER QUALITY Pኒ-ር%<Γ'ଦେଶ୍ୱା በበ%bናገ' ሲልኒጭ/Lረ' - ΔL><ናb. Δኒ ው



### **Summary of Results continued...**

Volume 6 – Freshwater Environment

- Surface Water Quality
  - Dust and air emissions will have negligible effects on water quality
  - Flooding of Whale Tail Lake (South Basin)
    may result in increased concentrations of
    contaminants but given the short duration of
    flooding, the magnitude of effects is
    moderate.
  - Lakes and Rivers of cultural importance such as Innugugayualik and Pipedream lakes & tributaries of the Meadowbank River are not expected to be impacted
  - Changes to the downstream receiving environment from Mammoth Lake to Node 2 in one parameter over the long term (i.e. Phosphorus) with a return to baseline condition post-closure

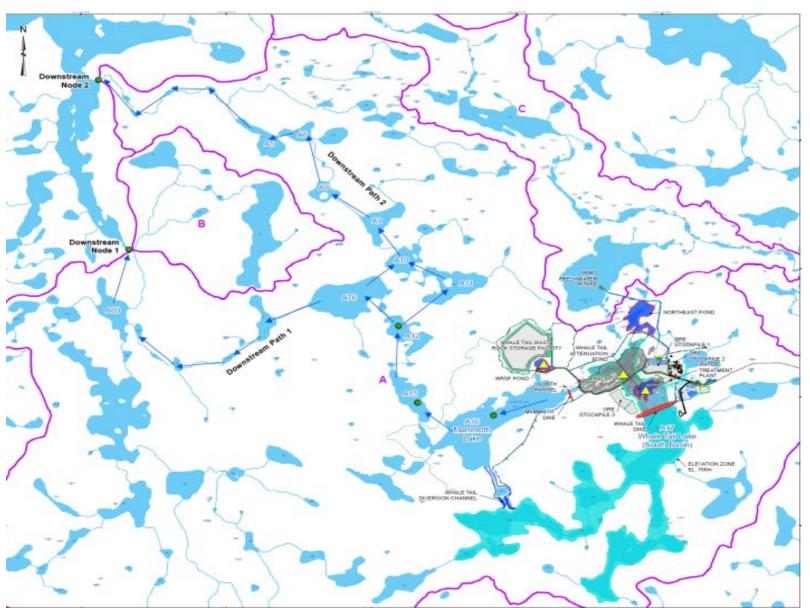
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### FEIS SUMMARY – WATER QUALITY PUCCECLOSIS CONTRACTOR OF SUMMARY – WATER QUALITY PUCCECLOSIS CONTRACTOR OF SUMMARY – WATER QUALITY







# FEIS SUMMARY – FISH AND FISH HABITAT Pኄ-CᅆሩՐ፡ 〈 C ଦେ୯ - ଦେଶ୍ୱ - ଦେଶ୍ୱ

### **Summary of Results continued...**

- Fish and Fish Habitat
  - Indirect effects to fish and fish habitat are predicted
  - Measurable effects within the local study area including dewatering of Whale Tail Lake (north basin) and flooding of Whale Tail Lake (South Basin)
  - Permanent habitat loss due to Whale Tail
     Dike and Mammoth Dike footprints
  - Downstream changes to flows
  - Reflooding Whale Tail Lake (North Basin),
     breaching the dikes and returning the water
     levels and flows to the natural levels

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  - ずっくてっぱんしんしゅんしんずんしん
  - $\Delta^{L}\Gamma^{G}D\Delta^{b}D^{G}\sigma^{G}\sigma^{G}Whale Tail CY^{G}C (DD^{G}\Delta^{C}L\sigma^{C}),$   $D^{G}LD^{G}L\Delta^{G}DL$



- Fishout is planned to begin in open water season of 2018
- Fish transferred from Whale Tail Lake North Basin to South Basin
- Conceptual Whale Tail Lake (North Basin) Fishout Workplan to NIRB/ DFO on Feb 28, 2017.
- The benefit of backflooding Whale Tail is to create a "reservoir" for fish/ fisheries productivity during operations











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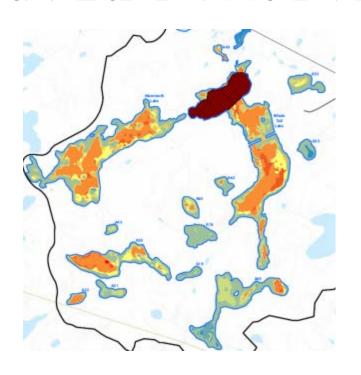


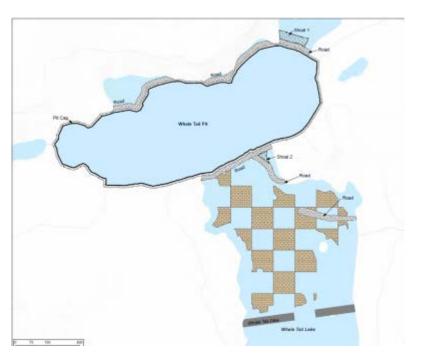




| WHALE TAIL PIT REGULATORY PRESENTATION| 29



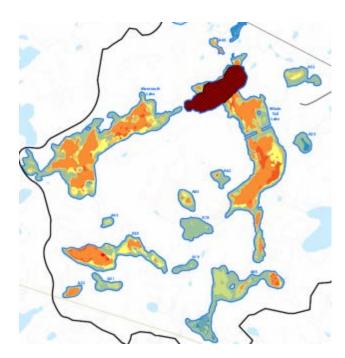




- For consistency, the Meadowbank Habitat Evaluation Procedure (HEP) methods were used for the Whale Tail Pit Project Conceptual Offsetting Plan
- → Volume 8 Appendix 8-E.4 Conceptual Offsetting Plan

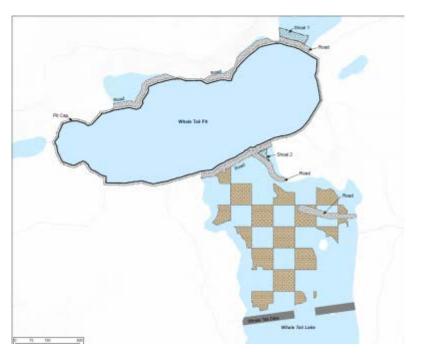
# CONCEPTUAL FISHERIES OFFSETTING PLAN CDOしたでかららいらいらいらいらいらいらいらいらいらいらいというによっている。





### Conceptual offsetting may include:

- Onsite habitat creation (new habitat creation, improved the connection between Mammoth and Whale Tail Lake);
- Offsite habitat creation (e.g., Arctic grayling spawing pads); and
- Complimentary measures (including research and sustainable projects that are intended to provide direct benefits to the community of Baker Lake)



### $\nearrow$ CDDLD4' $\checkmark$ CPDLD4' $\checkmark$ CPDLAG $\checkmark$ CPDC $\checkmark$

- $-\Delta\sigma P + \Gamma^c \Delta\sigma C P \wedge \sigma^{5b} (\Delta C^c \Delta\sigma P + C^5 \Delta\sigma, AP + C^5 P^c D + C^5 P^c D$
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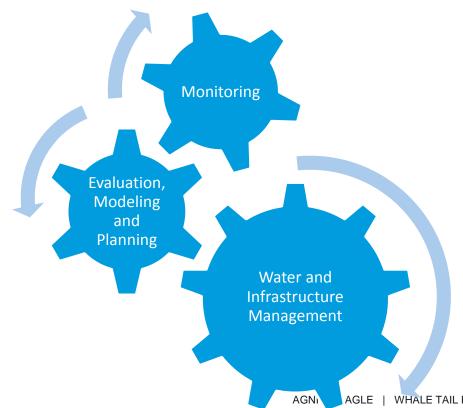
- Agnico Eagle is committed to the concepts presented in the offsetting plan
- Will continue to work with DFO and KivIA to finalize:
  - The Final Offsetting Plan
- Committed to finalizing the complimentary measures including:
  - research projects to provide regional benefits, and
  - sustainability projects that are intended to provide direct benefits to the community of Baker Lake (example - research and studies for Baker Lake sewage treatment)

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# ADAPTIVE MANAGEMENT



- Adaptive Management requires continuous monitoring, evaluation, modeling and planning, with a feedback loop for continuous improvement
- This will result in adapting infrastructure, management plans, and mitigation accordingly

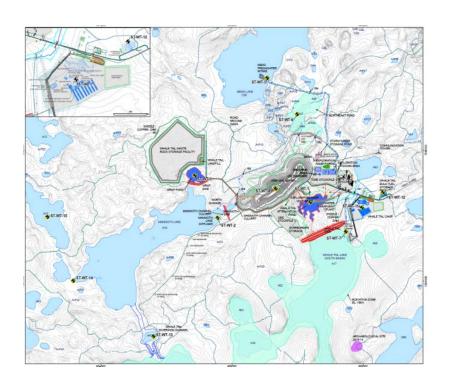


### ADAPTIVE MANAGEMENT



- Applying lessons learned from Meadowbank
- Continuous improvement
- Transferable monitoring locations and approaches between sites and Type A Licenses including requirements for:
  - sampling and modeling

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