Giant Mine Remediation Project

Northwest Territories

Canada

Treated Mine Water Outfall – Diffuser

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- Diffuser location and configuration
- Regulatory requirements
- Effluent plume results
- Ice Thickness Monitoring
- Summary

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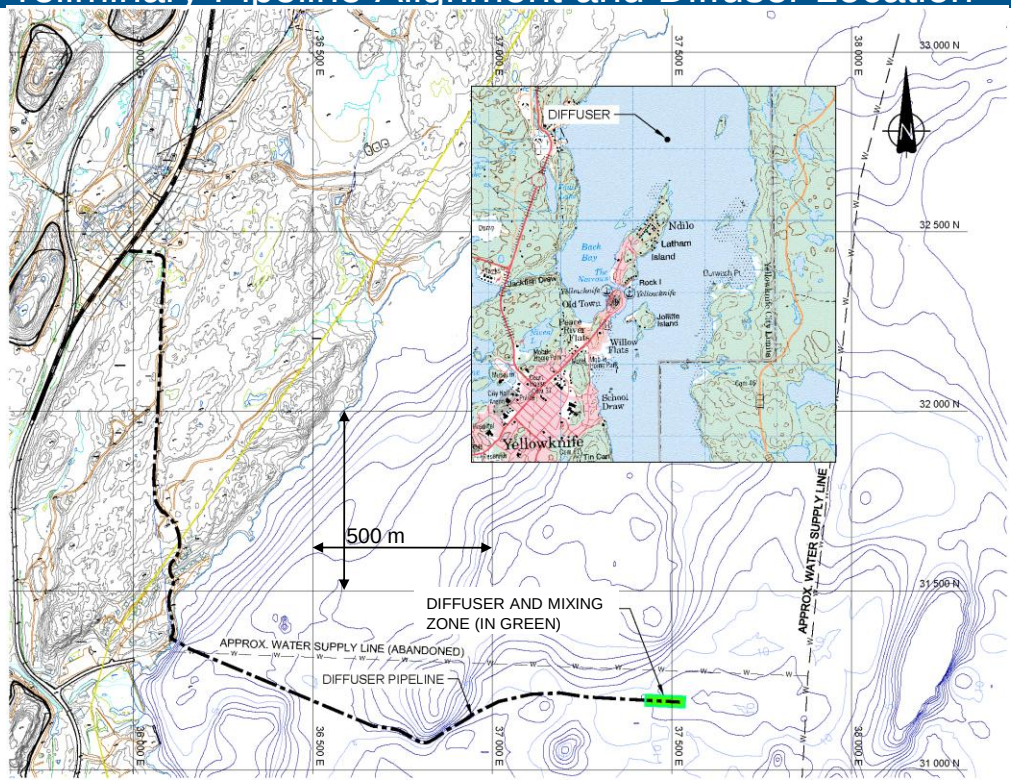
Preliminary Pipeline Alignment and Diffuser Location



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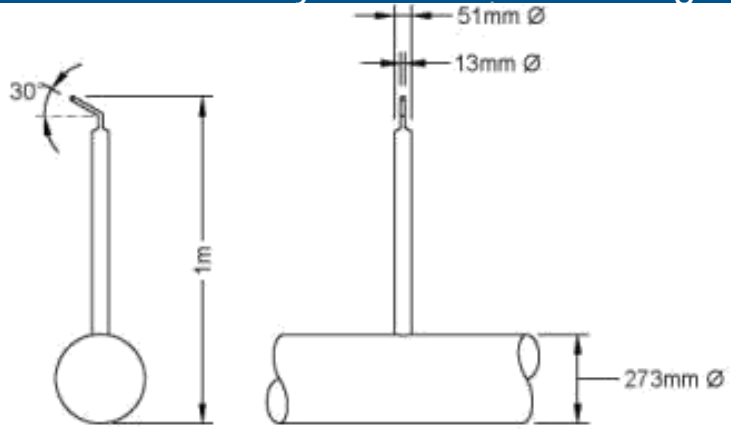
Proposed Preliminary Diffuser Port Configuration



Parameter	Value
Length of diffuser (m)	81
Number of ports	28 (short term) and 18 (long term)
Discharge pattern	Alternate opposing direction
Distance between pairs of ports (m)	3
Port diameter (m)	0.013 (or 0.5 inch)
Pipeline diameter (m)	0.273 (or 11 inches)
Angle of ports from the reservoir bottom (˚)	30
Height of ports from the reservoir bottom (m)	1 (or 3.28 feet)
Minimum discharge flow (l/s)	20 (short term) and 15 (long term)

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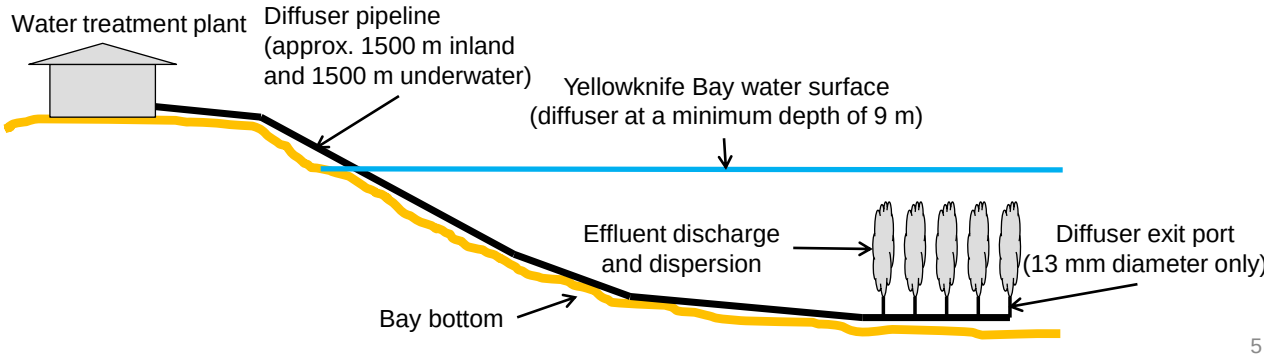
Schematic of a diffuser

1. Diffuser ports diameter for Giant diffuser would be very small (13 mm only)

2. Pipeline protected against ice at the shoreline by burial

3. Diffuser exit ports at height above bay bottom to minimize sediment disturbance



5

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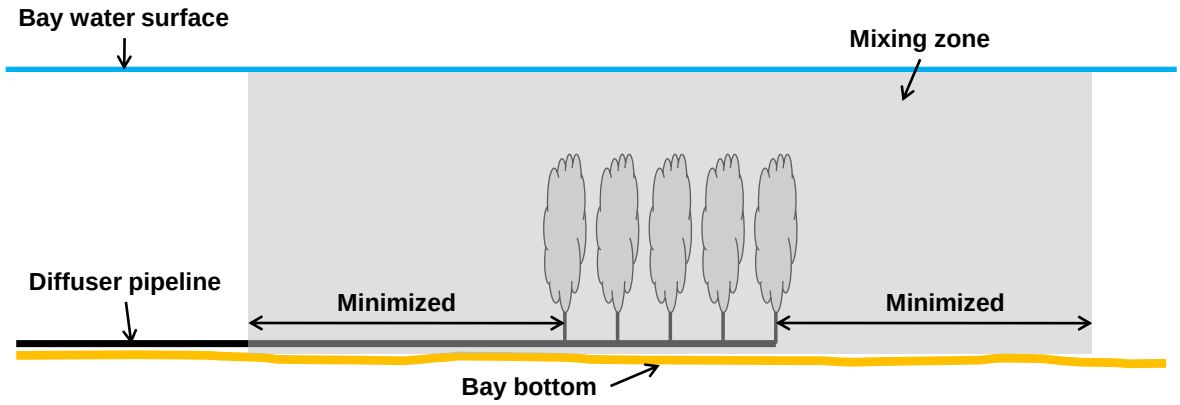
Diffuser mixing zone



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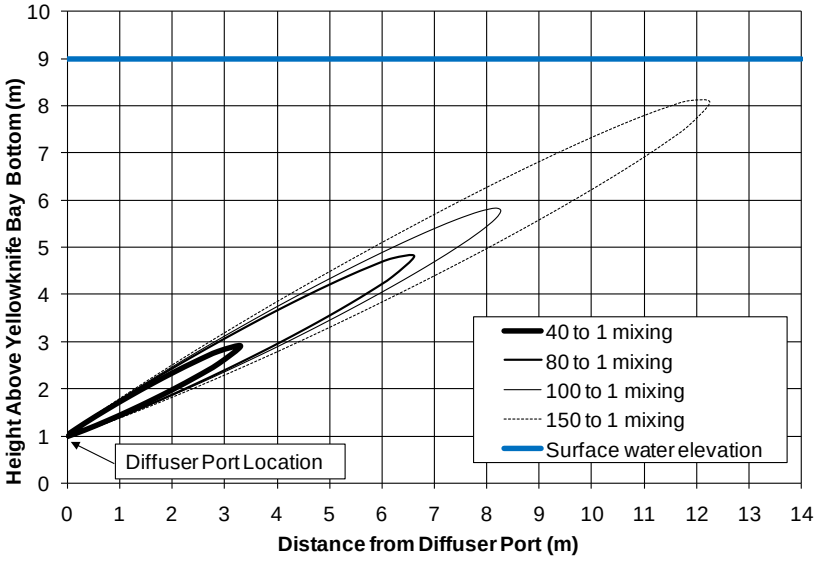
Effluent Dilution from a Single Port for an Un-Stratified Ambient Water Column

Open Water Period



Worst ambient conditions, with near stagnant current.
Effluent plume shown above is the same for each port

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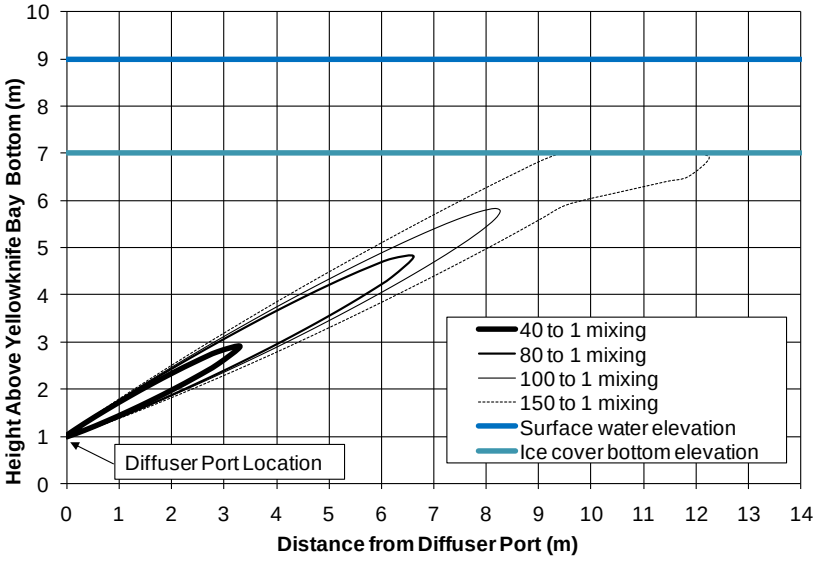
Effluent Dilution from a Single Port for an Un-Stratified Ambient Water Column

Ice Cover Period



Worst ambient conditions, with near stagnant current.
Effluent plume shown above is the same for each port

8

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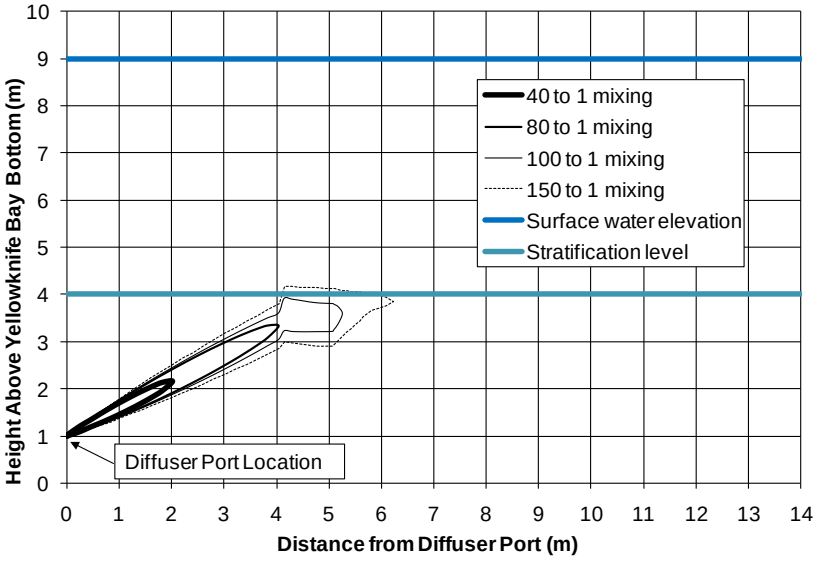
Effluent Dilution from a Single Port for a Stratified Ambient Water Column

Profile view



Worst ambient conditions, with near stagnant current.
Effluent plume shown above is the same for each port

9

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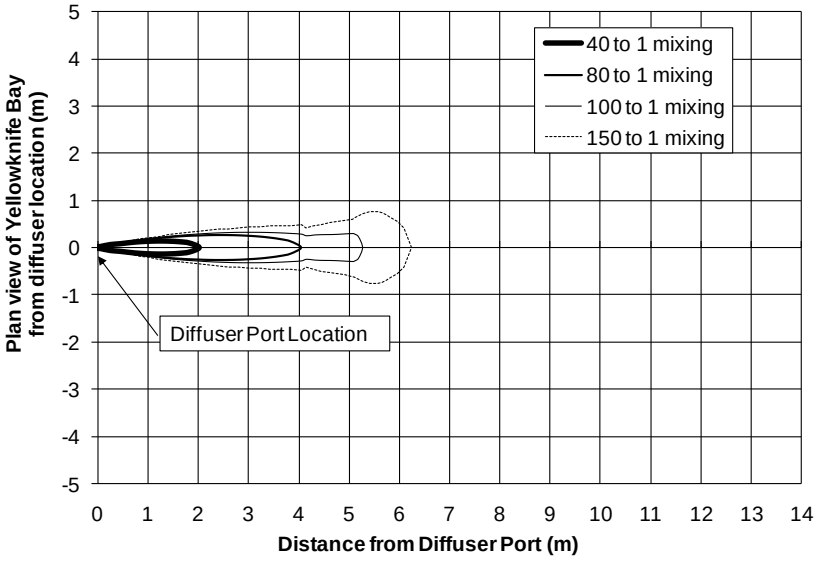
Effluent Dilution from a Single Port for a Stratified Ambient Water Column

Plan view



Worst ambient conditions, with near stagnant current.
Effluent plume shown above is the same for each port

- Ice cover:
  - Discharge temperature between 2°C and 8°C
  - Local thinning of the ice cover may occur, and the potential for this will be further investigated during the diffuser detailed design phase.
  - Thinning, if any, would be local and may be further minimized by adjusting the port angle

- Bottom sediment:
  - Diffuser ports located 1 m above the bay bottom to minimize sediment entrainment from the port jets.
  - Ports angled toward the water surface to avoid direct contact of port jets with bay bottom

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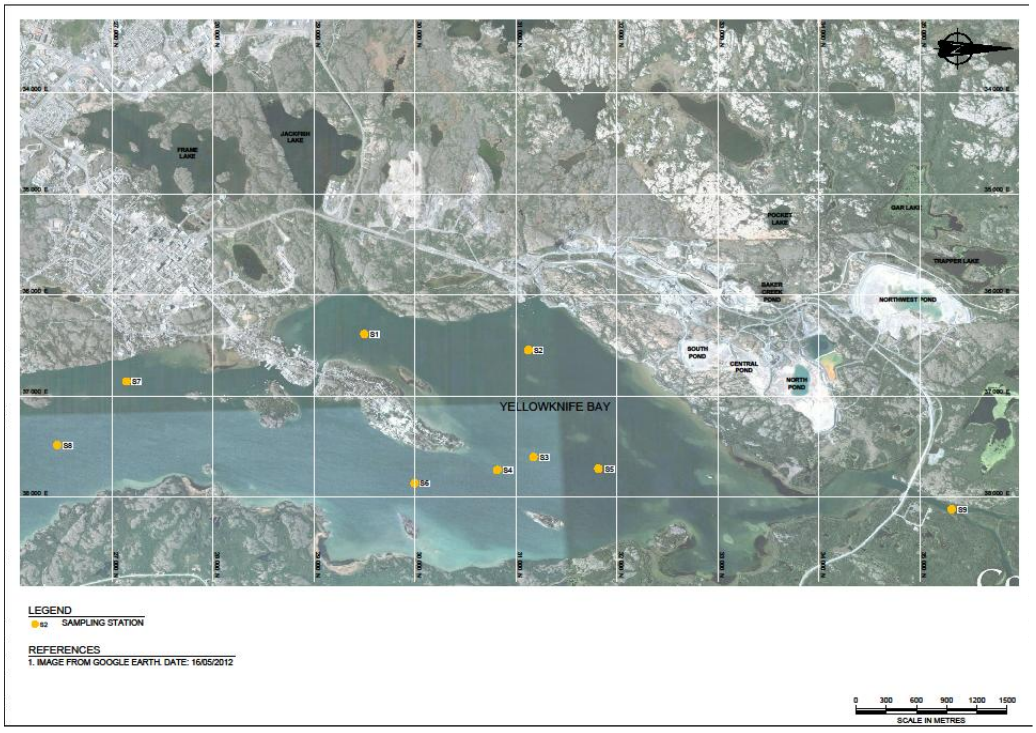
Ice Thickness Sample Locations



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Maximum Water Depth, Snow Depth and Ice Thicknesses

Station	Maximum Water Depth (m)		Snow Depth (m)		Ice Thickness (m)	
	February	March	February	March	February	March
S1	6.6	7.0	0.12	0.25	0.79	1.03
S2	9.5	9.7	0.20	0.20	0.74	0.96
S3	11.1	11.0	0.10	0.30	0.90	1.06
S4	12.0	11.8	0.10	0.30	0.93	1.10
S5	6.1	6.6	0.14	0.20	0.79	1.03
S6	17.0	16.8	0.11	0.15	0.88	1.12
S7	7.5	8.0	0.13	0.20	0.80	1.04
S8	7.3	7.4	0.12	0.20	0.80	0.92
S9	4.4	4.5	0.06	0.20	0.25	0.20
Mean	**9.1**	**9.2**	**0.12**	**0.22**	**0.76**	**0.94**
Minimum	**4.4**	**4.5**	**0.06**	**0.15**	**0.25**	**0.20**
Maximum	**17.0**	**16.8**	**0.20**	**0.30**	**0.93**	**1.12**

Summary

- Design water quality criteria for the bay were established based on regulatory guidelines and background concentrations.
- The diffuser was configured to achieve an effluent mixing that meets the water quality guideline for all constituents (including arsenic) within a mixing zone of 15 m around each diffuser port.
- The diffuser is configured to minimize entrainment of bottom sediment.
- Effects on ice cover, if any, could be mitigated by adjusting the port angle during detail design phase.

Summary

- The plan to collect data for detailed design has started
- The water quality monitoring has started with next step in September for water quality and current determinations in the study area
- Second ice thickness determination in January, plus water quality and current monitoring under ice
- The diffuser is configured to minimize entrainment of bottom sediment and sediment study is planned.
- Fish habitat study is also planned to provide input for fisheries authorization.