NIRB File No.: 05MN047 & 12MN001
December 22, 2021

Keith Morrison
Manager, Impact Assessment
Nunavut Impact Review Board
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Cambridge Bay, NU, X0B 0C0

Sent via Email: kmorrison@nirb.ca; info@nirb.ca

Re: Roberts Bay Discharge System – Revised Discharge Point

Dear Mr. Morrison,

Further to the correspondence in February 2021, please find attached an update on the activities surrounding the Roberts Bay Discharge System (RBDS).

The attached memo includes information on the status of the RBDS diffuser and the spatial extent of the discharge influence.

Should you have any questions on the matter, please contact myself.

Regards

Nancy Duquet-Harvey
Environmental Superintendent
Agnico Eagle Mines – Hope Bay

Cc:
Nunavut Impact Review Board Administrator (NIRB)
Eric Steinmetzer (General Manager, Hope Bay)
Oliver Curran (Senior Advisor Environment and Permitting Nunavut)
Alex Buchan (Director, Western Nunavut Affairs)
John Roesch (Senior Hope Bay Project Officer, Kitikmeot Inuit Association)

Attachment 1
Roberts Bay Discharge Configuration Update (Minnow 2021)

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December 15, 2021

Nancy Duquet Harvey
Environmental Superintendent
Hope Bay Mine
Agnico Eagle Mines Ltd.

Re: Roberts Bay Discharge Configuration Update

Dear Ms. Duquet Harvey,

This memo has been prepared to update the Nunavut Impact Review Board ("**NIRB**") on the current status of the Roberts Bay discharge system and the spatial extent of discharge influence in Roberts Bay until the diffuser can be installed.

Background

During maintenance of the Roberts Bay Discharge System (RBDS) in fall 2020, portions of the submerged discharge line in Roberts Bay became buoyant and rose to the underside of the sea ice. To resolve the issue, the discharge line was cut at 1.4 km from shore to release the trapped air and enable both sections of the line to be laid back to the ocean bottom. This event resulted in the need to modify the discharge location of the RBDS, which now ended at 20 m depth, 1.4 km from shore, rather than at 40 m depth, 2.4 km from shore. Information in the form of a self-assessment was provided to the NIRB on February 19, 2021 (Agnico Eagle 2021), including the plan for the installation of a diffuser at the new location, updated modelling (with and without a diffuser) and an assessment of monitoring that had been conducted (Minnow 2021b). The NIRB subsequently confirmed that the new discharge location did not constitute a significant Project modification.

In order to maintain water balance within the Tailings Impoundment Area and water from the underground mine, Hope Bay Mine discharged water through the 2021 season from the modified discharge location, with planned installation of a diffuser during the open water season, as outlined during previous communications with the NIRB. In July 2021, the cut section of the pipe was successfully removed from the seabed as planned. However, due to troubleshooting of some air entrainment in the pipeline, the reattachment of the diffuser was postponed to September. The diffuser reattachment team was mobilized to site at mid-September. However, during this time the boats planned to be used for this work had engine failures and/or were taking in water, rendering the work unsafe to be completed. Repairs to the boats could not be completed before the freezing of Roberts Bay. The diffuser could not be installed as planned and therefore the 'end

of pipe' configuration is still in place for effluent discharge to Roberts Bay. Installation of the diffuser is now planned for open-water season 2022.

Modelling Results

Modelling results for the 'end of pipe' discharge at 20 m water depth predict that the effluent plume will rise vertically in the water column due to the fact that the effluent density is lower than that of the receiving water for both the winter ice-cover and open-water model conditions (Minnow 2021a). The rising vertical effluent plume impinges at different water depths before spreading horizontally depending on the seasonal conditions.

The effluent plume is predicted to rise through the entire water column to reach at or near the ice-cover in the winter ice-cover scenarios, at which point effluent will be diluted to 2.5% (Table 1). During the open water season, effluent is predicted to trap at an intermediate water depth between 9 m and 13 m before spreading horizontally. This is due to freshwater inputs to the bay and the resultant density gradient with depth. Once it reaches this trapping depth during the open water season, effluent would be diluted to a concentration of 3.4% (Table 1).

For the winter ice-cover scenarios, effluent dilution is predicted to reach <3% within 9 m of the outfall, even for the worst-case dilution condition in Roberts Bay (i.e., without any velocity; Table 1). For the open-water season scenarios, effluent dilution is predicted to reach 4.3% within 13 m of the outfall, beyond which effluent mixing will mostly be dictated by the receiving water hydrodynamic condition. For an average ambient water velocity of 5 cm/s, the predicted maximum extent of 1% dilution is 208 m during the open water season (Table 1, Figure 1). Under these conditions, the ambient water velocity carries effluent in a northerly direction. Under the worst-case scenario, although the distance to 5% dilution is greater than the average case scenario (Table 1), the lack of ambient current results in more radial dispersion, rather than directional. Therefore, the distance at which 1% effluent dilution is achieved is expected to be less than under average conditions with ambient current, as effluent would disperse in all directions.

Influence on Roberts Bay

Under all discharge configurations and scenarios (both without and with a diffuser), the spatial extent of the effluent plume from the Hope Bay Project discharge to Roberts Bay remains small, with federal water quality guidelines met within 3 m of the discharge (Minnow 2021b). No significant adverse effects to aquatic biota within Roberts Bay are predicted in open water or under ice as a result of the delayed install of the diffuser (or with a diffuser once installed).

The Metal and Diamond Mining Effluent Regulations (MDMER) specify conditions for when biological monitoring is required in the receiving environment under Environmental Effects Monitoring (EEM) based on the potential for risk to the environment. If effluent concentrations are greater than 1% at a distance of 250 m from the discharge location, a fish health survey is required, and if concentrations are greater than 1% at a distance of 100 m from the discharge, a benthic invertebrate survey is required. Effluent concentrations of 1% were predicted to extend to 208 m for the temporary, 'end of pipe' discharge (Minnow 2021a). Therefore, a benthic

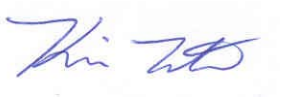
invertebrate survey will be completed in 2022 for the EEM to assess biological conditions in Roberts Bay. However, based on the low risk to the environment, a fish health study is not required.

Conclusion

With the Hope Bay Project's revised location of effluent discharge to Roberts Bay, the overall influence of effluent is not expected to change and no significant adverse effects to aquatic life are predicted, based on a combination of detailed modelling results and past water quality monitoring. Biological conditions in Roberts Bay will be assessed through benthic invertebrate community monitoring under the EEM program, which will be completed in 2022. Once the diffuser is installed, effluent will be diluted to less than 1% within 40 m under average conditions and water quality is expected to remain at concentrations below federal water quality guidelines (and for most parameters below detection limits).

Sincerely,

Minnow Environmental Inc.



Kevin Martens, B.Sc., R.P.Bio

Senior Aquatic Ecologist

cc: Pierre Stecko, Senior Aquatic Scientist

References

Minnow Environmental Inc. (Minnow). 2021a. Near-field Mixing Modelling for the Planned Effluent Discharge from the Hope Bay Project into Roberts Bay. Memo prepared for TMAC Resources Inc. January 2021.

Minnow. 2021b. Roberts Bay Discharge – Supporting Information for the NIRB. Memo prepared for Hope Bay Mine. February 2021.

Agnico Eagle Hope Bay. 2021. Roberts Bay Discharge – Revised Discharge Point. Self Assessment document submitted to the NIRB. February 19, 2021.

Table 1: Predicted Spatial Extents of the Outermost Edge of Effluent Concentration Plumes for the Effluent Discharge Into Roberts Bay Under Different Discharge and Receiving Water Conditions

Scenario			Effluent Discharge Rate[b] (m^3/day)	Receiving Water Velocity (m/s)	CORMIX™ Model Predictions								
Simulation #	Seasonal Condition	Receiving Water Dilution Condition[a]			Trapping Depth[c] (m)	% Effluent at Trapping Depth	Maximum Spatial Extent of the Effluent Plume (meters from the point of effluent entry)					NFR Extent[e] (m)	% Effluent Plume at NFR
							50%	25%	10%	5%	1%		
1	Winter Ice-cover	Average	7,053	0.01	0	2.5%	3	6	8	8	N/A[d]	9	2.7%
2		Worst-Case		0.00	0 to 2		3	6	7	8	N/A[d]	9	2.8%
3	Open-water	Average		0.05	11 to 13	3.4%	3	4	7	10	208	30	1.8%
4		Worst-Case		0.00	9 to 12		3	5	7	12	N/A[d]	13	4.3%

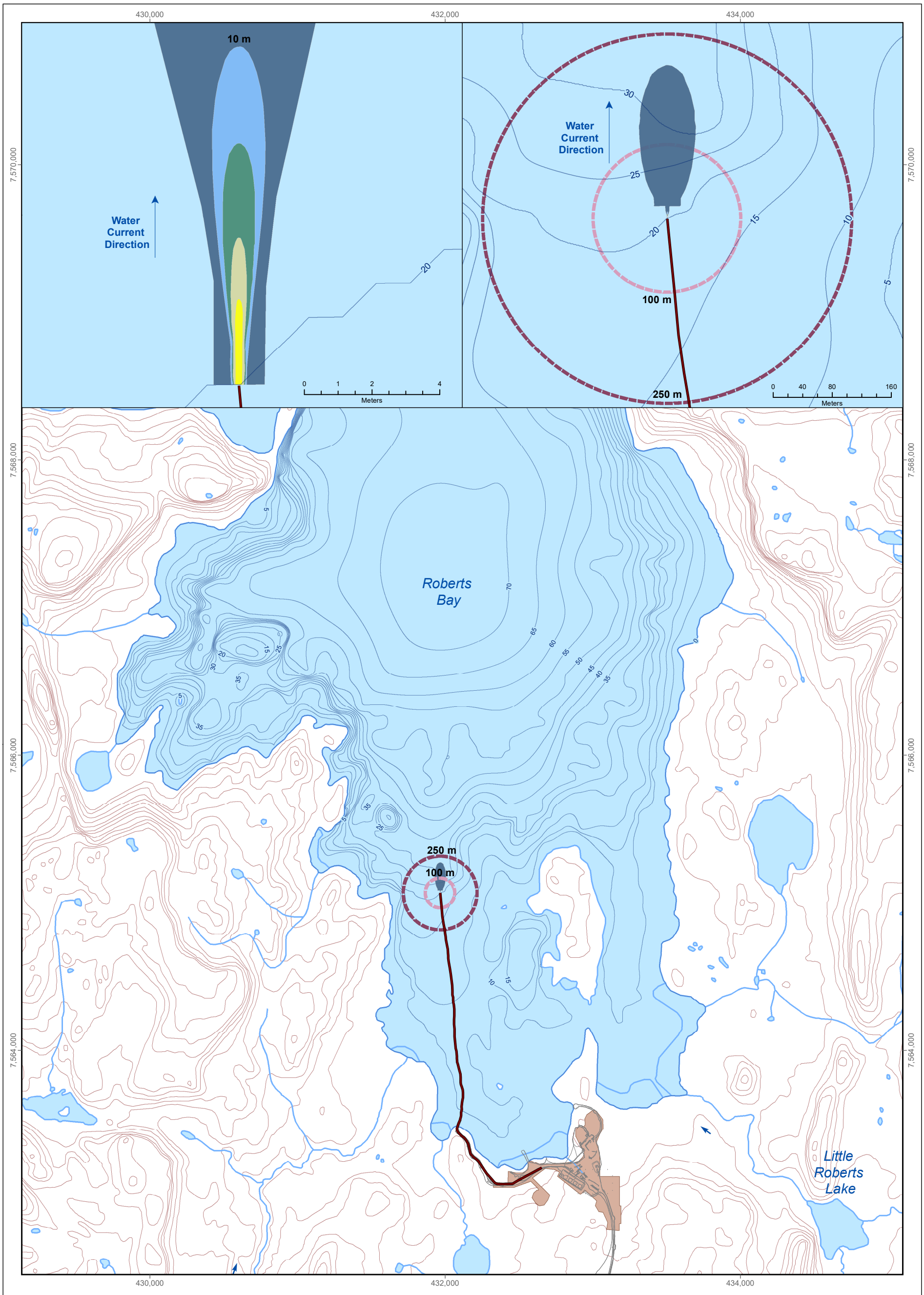
[a] The 'average' and 'worst-case' dilution conditions are modelled with average seasonal water velocity and no water velocity (i.e., calm condition) in Roberts Bay, respectively.

[b] All modelling scenarios were run with maximum effluent discharge rates from Roberts Bay Project in 2020.

[c] Depth at which the effluent plume is predicted to be trapped, in which 0 m denotes the water surface (open-water condition) or just below the ice-cover.

[d] 1% effluent plume was not predicted in the near-field model limit due to inadequate ambient water velocity.

[e] Predicted extent of the near-field region (NFR), where discharge-induced momentum or buoyancy dictates effluent dilution.



LEGEND

Effluent Plume Concentration (%)

- ≥ 1 %
- ≥ 5 %
- ≥ 10
- ≥ 25 %
- ≥ 50 %

Distance from Effluent Pipe

- 100 m
- 250 m

- Effluent Discharge Pipeline
- Infrastructure
- Contour (10 meter interval)
- Bathymetry (5 meter interval)
- Infrastructure

Predicted Effluent Plume with Average Roberts Bay Water Velocity (Open Water Condition)

0 0.375 0.75 1.5
km

N W E S

Date: December 2021
Project: 217202.0081

minnow environmental inc. A Trinity Consultants Company

Figure 1

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\TMAC Resources - 217202.0081 - Hope Bay EEM Support\D - GIS\Memo\21-81 Figure 1 Effluent Plume - Open Water Condition.mxd