



Water Resources Division
Resource Management Directorate
Nunavut Regional Office
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Your file - Votre référence
2AM-BRP1831
Our file - Notre référence
GCDOCS#105959414

October 6, 2022

Richard Dwyer
Manager of Licencing
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU, X0B 1J0
E-mail: licensing@nwb-oen.ca

Re: Crown-Indigenous Relations and Northern Affairs Canada's Review of Water and Load Balance Report and Hydrodynamic and Water Quality Modelling of Goose Lake Report for Water Licence 2AM-BRP1831

Dear Richard Dwyer,

Thank you for your August 31, 2022 invitation to review the above-referenced reports.

Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) reviewed the two reports pursuant to its mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Crown-Indigenous Relations and Northern Affairs Act*. Please find CIRNAC comments and recommendations in the attached Technical Memorandum.

If there are any questions or concerns, please contact me at david.zhong@rcaanc-cirnac.gc.ca or Andrew Keim at andrew.keim@rcaanc-cirnac.gc.ca.

Sincerely,

David Zhong,
Regulatory & Science Advisor

Canada 



Technical Review Memorandum

Date: October 6, 2022

To: Richard Dwyer, Manager of Licensing, Nunavut Water Board

From: David Zhong, Regulatory & Science Advisor, CIRNAC

Subject: Crown-Indigenous Relations and Northern Affairs Canada's Review of Water and Load Balance Report and Hydrodynamic and Water Quality Modelling of Goose Lake Report for Water Licence 2AM-BRP1831

Region: Kitikmeot

A. BACKGROUND

On August 31, 2022, the Nunavut Water Board (NWB) invited interested parties to submit comments on the Water and Load Balance Report and the Hydrodynamic and Water Quality Modelling of Goose Lake Report, submitted by Sabina Gold & Solver Corporation (the licensee) as part of the requirements of its Water Licence 2AM-BRP1831 for its Back River Gold Mine Project (Project) in the West Kitikmeot Region of Nunavut, 95 km southeast of the Bathurst Inlet.

Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) reviewed the two reports pursuant to its mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Crown-Indigenous Relations and Northern Affairs Act*. A summary of the subjects of CIRNAC's comments and recommendations regarding the two reports can be found in Table 1. Documents reviewed as part of this submission can be found in Table 2 of Section B. Detailed technical review comments are in Section C.



Table 1: Summary of Comments and Recommendations

Recommendation Number	Subject
R-01	Tailings Management Facilities as Chemical Load Source Term
R-02	Pit Walls as Chemical Load Source Term in Closure and Post-closure Phases
R-03	Waste Rock or Tailings Buried below Thermal Active Layer or under Water Cover as Chemical Load Source Term
R-04	Predicted Concentrations at Prediction Nodes in Winter Months
R-05	Predicted Concentrations at Prediction Nodes during Operation Phase
R-06	Goose Lake Bathymetry
R-07	Predicted Selenium Concentrations in Goose Lake
R-08	Predicted Phosphorous Concentrations in Goose Lake

B. DOCUMENTS REVIEWED AND REFERENCED

The following table (Table 2) provides a list of the documents reviewed under the submission and reference during the review.

Table 2: Documents Reviewed and Referenced

Document Title	Author, File No., Rev., Date
Water and Load Balance Report	Sabina Gold & Silver Corp. August 30, 2022 (Prepared by Golder Associates Ltd.)
Hydrodynamic and Water Quality Modelling of Goose Lake Report	Sabina Gold & Silver Corp. August 29, 2022 (Prepared by Golder Associates Ltd.)
Water Licence 2AM-BRP1831	Nunavut Water Board, November 6, 2018
Water Licence 2AM-BRP1831 Amendment 1	Nunavut Water Board, October 15, 2021



C. RESULTS OF REVIEW

1. Tailings Management Facilities as Chemical Load Source Term

Comment:

Section 2.1 of the Water and Load Balance Report summarized the major infrastructure at the Goose Property mine site, including three tailings management facilities (i.e., Echo Open Pit as Echo Tailings Management Facility (TMF), Umwelt Open Pit as Umwelt TMF, and Llama Open Pit as Llama TMF).

Table 11 of the Water and Load Balance Report listed all the source terms applied in the model for load balance calculation. It seems, however, that the three TMFs are not included as source term in the model. It is well established that tailings management facilities could be important chemical load sources for the quality of tailings porewater, overlying surface water, and groundwater.

Recommendation:

(R-01) CIRNAC recommends that the licensee clarify and justify if and how tailings management facilities are treated as chemical load source term in the model.

2. Pit Walls as Chemical Load Source Term in Closure and Post-closure Phases

Comment:

The Project has four open pits (i.e., Echo, Umwelt, Llama, and Goose). Waste rock on the walls of the open pits could be important chemical load sources during the operation phase, as well as in the closure and post-closure phases of the project.

Based on information provided in Table 11 of the Water and Load Balance Report, it seems, however, that the pit walls are considered as chemical load sources for the operation phase of the project only.

Recommendation:

(R-02) CIRNAC recommends that the licensee clarify and justify if and why pit walls are not considered as chemical load source term in the closure and post-closure phases of the project.



3. Waste Rock or Tailings Buried below Thermal Active Layer or under Water Cover as Chemical Load Source Term

Comment:

Section 8.2 of the Water and Load Balance Report summarized the key assumptions and uncertainties of the load balance component of the Model.

Although it appears that waste rock or tailings that are buried below the thermal active layer or under permanent water cover are not considered as chemical load source term in the model, this assumption is not discussed in Section 8.2 of the report.

CIRNAC notes that thermal monitoring of waste rock management facilities at a number of mining project sites in Nunavut in recent years has shown that part of the waste rock or tailings that are encapsulated below the thermal active layer may remain unfrozen or undergo the annual freeze-thaw cycle. Furthermore, submerging waste rock or tailings in water may reduce the rate of sulfide mineral oxidation; it would not, however, prevent metal leaching from waste rock and tailings.

Recommendation:

(R-03) CIRNAC recommends that the licensee clarify and justify if and why waste rock or tailings that are buried below the thermal active layer or under permanent water cover are not considered as chemical load source term in the model.

4. Predicted Concentrations at Prediction Nodes in Winter Months

Comment:

Appendix F of the Water and Load Balance Report presented the Timeseries of Predicted Monthly Average Constituent Concentrations at the Prediction Nodes Under Average Hydrological Conditions.

It seems that the predicted monthly average concentrations of all the modeled constituents exhibit an annual cycle: increasing to a maximum in the summer and decreasing to a concentration of zero in the winter months.

Although it is expected that constituent concentrations would change as a function of time or season due to changes in hydrology, geochemical reactions, and mining activities, etc., it would be difficult, if not impossible, to expect that concentrations of all constituents would decrease to zero in the winter months.



Recommendation:

(R-04) CIRNAC recommends that the licensee clarify and explain if and how the concentrations of all constituents decrease to zero in the winter months.

5. Predicted Concentrations at Prediction Nodes during Operation Phase

Comment:

Appendix F of the Water and Load Balance Report presented the Timeseries of Predicted Monthly Average Constituent Concentrations at the Prediction Nodes Under Average Hydrological Conditions.

It seems that the predicted monthly average concentrations of all the modeled constituents repeat themselves from one year to another at all the Prediction Nodes during the operation phase of the project.

Although the average hydrological conditions (i.e., monthly distributed precipitation, evaporation, and air temperature) were assumed to be repeating from one year to another in the model, other factors that would impact water quality, such as mining footprints and mining activities, quantities of waste rock and tailings, and mine site water management, would change from one year to another during the operation phase of the project. It is therefore hard to make sense of the year-to-year repetitions of the predicted monthly average constituent concentrations at the Prediction Nodes during the operation phase of the project.

Recommendation:

(R-05) CIRNAC recommends that the licensee clarify why there is a yearly repetition of the predicted monthly average concentrations of all constituents at the Prediction Nodes during the operation phase of the project.

6. Goose Lake Bathymetry

Comment:

Figure 1 in Section 3.1 of the Hydrodynamic and Water Quality Modelling of Goose Lake Report presented the bathymetry and model mesh of Goose Lake.

CIRNAC notes that there is an apparent increase in areas of Goose Lake with depth greater than 14 meters when compared to data presented in Figure 1 of the 27 May 2021 Effluent Quality Criteria Report for Effluent Discharged from Tailings Facilities, Tailings Storage



Facilities, or Reservoirs (Version 1). However, no discussion is provided on this apparent change in Goose Lake bathymetry.

Recommendation:

(R-06) CIRNAC recommends that the licensee explain the changes in Goose Lake bathymetry presented in this report vs. data from the previous reports.

7. Predicted Selenium Concentrations in Goose Lake

Comment:

Appendix B and Appendix C of the Hydrodynamic and Water Quality Modelling of Goose Lake Report presented the timeseries of model predicted constituent concentrations at the edges of the mixing zones and at the assessment stations, respectively. CIRNAC notes that the predicted concentrations for iron, phosphorous, and selenium would sometimes be above the applicable water quality benchmarks at PN04, PN05, and/or GLTL during the closure phase of the project.

While in Section 7.1 of the Hydrodynamic and Water Quality Modelling of Goose Lake Report, the licensee provided discussions on the subject of the predicted concentrations of iron and phosphorous being above the water quality guidelines in the report, no such discussion is given on the predicted concentrations of selenium, which is also above the applicable water quality guideline sometime during the closure phase of the project. Given that selenium can be toxic to aquatic life at elevated concentrations, such a discussion is warranted.

Recommendation:

(R-07) CIRNAC recommends that the licensee provide a discussion on the predicted concentrations of selenium in Goose Lake and any appropriate mitigation measures.

8. Predicted Phosphorous Concentrations in Goose Lake

Comment:

In discussing the subject of the predicted concentrations of phosphorus being above the applicable water quality guideline in Section 7.1 of the Hydrodynamic and Water Quality Modelling of Goose Lake Report, the licensee interpreted the model predictions as a result of overestimation because phosphorus was treated conservatively and no biological uptake of phosphorus was considered in the model.



Increases in biological uptake of phosphorous, however, are associated with increases in biological productivity in the lake and consequently, would result in changes in the trophic status of the lake. Such changes have been observed in other mining project sites in Nunavut.

Recommendation:

(R-08) CIRNAC recommends that the licensee quantify if the predicted increases in biological uptake of phosphorous would result in changes in the trophic status of Goose Lake.