Environmental Protection Operations Directorate
Prairie & Northern Region
5019 52nd Street, 4th Floor
P.O. Box 2310
Yellowknife, NT X1A 2P7

ECCC File: 6100 000 115/002
NWB File: 2AM-BRP1831

June 15, 2021

via email at: licensing@nwb-oen.ca

Stephanie Autut
Executive Director
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0

Dear Stephanie Autut:

RE: Licence #2AM-BRP1831 – Sabina Gold & Silver Corp. – Back River Project – ECCC Final Written Submission

Environment and Climate Change Canada (ECCC) has reviewed the information submitted to the Nunavut Water Board (NWB) regarding the above-mentioned Water Licence Amendment Application. You will find our Final Written Submission, attached.

ECCC's specialist advice is based on our mandate pursuant to the *Canadian Environmental Protection Act* and the pollution prevention provisions of the *Fisheries Act.*

If you need more information, please contact Orlagh O'Sullivan at (431) 276-4506 or Orlagh.OSullivan@Canada.ca.

Sincerely,

Margaret Fairbairn
Regional Director

Attachment

cc: Jody Small, Head, Environmental Assessment North (NT and NU)
Orlagh O'Sullivan, A/ Senior Environmental Assessment Officer

Environment and Climate Change Canada
Environnement et Changement climatique Canada

ENVIRONMENT AND CLIMATE CHANGE CANADA'S FINAL WRITTEN SUBMISSION TO THE NUNAVUT WATER BOARD

RESPECTING THE TYPE A WATER LICENCE AMENDMENT APPLICATION FOR THE BACK RIVER PROJECT PROPOSED BY SABINA GOLD & SILVER CORP.

JUNE 15, 2021

Executive Summary

Sabina Gold and Silver Corp. (the Proponent) is proposing to amend their Type A Water Licence (WL) No: 2AM-BRP1831 for the Back River Project (the Project). The Project is a gold mine located in the Kitikmeot Region of Nunavut, Canada.

In their Amendment Application the Proponent has proposed changes to the previously approved Project activities, including changes to the Goose Property (Airstrip Extension, Umwelt Underground Extension, Total Water Use Increase), the Goose Property Waste and Water Management, Marine Laydown Area (Fuel Transfer Area, Airstrip Extension), Marine Laydown Area Shoreline Pad Extension, and Winter Ice Road (Subbase Upgrade, Service/Emergency Camps, and Total Water Use Increase).

Environment and Climate Change Canada (ECCC) has participated in all phases of the WL amendment review process thus far, providing specialist, expert information or knowledge available to the department in accordance with the Nunavut Agreement. ECCC has provided comments on the preliminary technical assessment completeness check and has undertaken a full technical review of the application. ECCC has also attended the Technical Meeting and Pre-Hearing Conference held via videoconference on March 26, 2021.

ECCC is now submitting our Final Written Submission (FWS), which summarizes the results of our technical review of information provided by the Proponent, as well as information and commitments provided by the Proponent throughout the review process thus far. ECCC's comments and recommendations provided in the FWS relate to our mandate in the context of the *Canadian Environmental Protection Act* (CEPA) and the pollution prevention provisions of the *Fisheries Act* (FA), and are intended for consideration by the NWB.

ECCC's outstanding comments are in regards to water quality and bedrock fracture zones, and in particular, with respect to the updated hydrodynamic model and the preliminary effluent quality criteria (EQC) for parameters of concern. In ECCC's technical comments of February 12, 2021, ECCC requested clarification regarding the 2-3m thick fracture zone in drill holes in the Tailings Storage Facility (TSF) foundation, and awaits the results of further testing to be conducted by the Proponent prior to TSF construction.

Table of Contents

1.0 List of Acronyms

$CaCO_3$	Calcium carbonate
CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act*
DOC	Dissolved Organic Carbon
ECCC	Environment and Climate Change Canada
EQC	Effluent Quality Criteria
FA	*Fisheries Act*
FWS	Final Written Submission
IR	Information Request
MDMER	*Metal and Diamond Mining Effluent Regulations*
NWB	Nunavut Water Board
SSWQO	Site-Specific Water Quality Objectives
TC	Technical Comment
TSF	Tailings Storage Facility
WL	Water Licence
WLA	Water License Amendment

2.0 Introduction

Sabina Gold and Silver Corp. (the Proponent) is proposing changes to the previously approved Type A Water Licence (2AM-BRP1831) for the Back River Project. The Project is a gold mine located in the Kitikmeot Region of western Nunavut, approximately 520 kilometers northeast of Yellowknife. The Back River Project includes two areas, the Goose Property and the Marine Laydown area, which are connected by winter ice roads. The proposed changes to the previously approved Project activities include:

- The Goose Property: Airstrip Extension, Umwelt Underground Extension, and Total Water Use Increase.
- The Goose Property Waste and Water Management Infrastructure.
- Marine Laydown Area: Fuel Transfer Area, Airstrip Extension, Shoreline Pad Extension.
- Winter Ice Road: Subbase Upgrade, Service/Emergency Camps, and Total Water Use Increase.

The amendment application was received by the Nunavut Water Board (NWB) on October 13, 2020. Environment and Climate Change Canada (ECCC) has participated in all phases of the WL amendment review thus far. ECCC has provided comments on the preliminary technical assessment-completeness check and has undertaken a full technical review of the Application. ECCC participated in a Technical Meeting and Pre-Hearing Conference that were held via videoconference on March 26, 2021. ECCC provides expert advice based on its mandate and we have provided expertise on modelling and management plans, including proposed effluent quality criteria (EQC) for parameters of concern.

ECCC is continuing our participation in this WL amendment review process by way of this Final Written Submission to the NWB, which summarizes ECCC's technical review of the information provided in the review process. ECCC has identified outstanding comments and provides recommendations for consideration by the NWB related to water quality and bedrock fracture zones.

3.0 ECCC's Mandate

The mandate of Environment and Climate Change Canada (ECCC) is determined by the statutes and regulations under the responsibility of the Minister of Environment and Climate Change. In delivering this mandate, ECCC is responsible for the development and implementation of policies, guidelines, codes of practice, inter-jurisdictional and international agreements, and related programs.

ECCC's specialist advice for this WL amendment review has been provided pursuant to the *Canadian Environmental Protection Act* (CEPA) and the pollution prevention provisions of the *Fisheries Act* (FA). ECCC regulates the use of toxic chemicals, and develops and implements environmental quality guidelines pursuant to CEPA. ECCC also administers the pollution provisions of the FA, which prohibits the deposit of a deleterious substance into fish-bearing waters.

Additional information on ECCC's mandate can be found at https://www.canada.ca/en/environment-climate-change/corporate/mandate.html.

4.0 ECCC's Technical Review Comments

This Final Written Submission summarizes the results of ECCC's technical review of the outstanding issues and the additional information provided by the Proponent following the Technical Meeting that was held by videoconference on March 26, 2021.

Subsection 36(3) of the *Fisheries Act*, administered by ECCC prohibits the discharge of deleterious substances to waters frequented by fish, or to a place where those substances might enter such waters.

ECCC has reviewed the information provided in the Proponent's Application, Proponent's responses to technical comments (TC), the Hydrodynamic and Water Quality Model, and other supporting documentation.

Based on responses provided by the Proponent to ECCC technical comments (February 12, 2021), and discussions and commitments at the Technical Meeting (March 26, 2021), ECCC considers the following comments to be addressed and fully resolved:

- ECCC-WLA-TC-01 – Resolved based on Proponent response
- ECCC-WLA-TC-03 – Resolved based on Proponent response
- ECCC-WLA-TC-04 – Resolved based on Proponent response
- ECCC-WLA-TC-05 – Resolved based on Proponent response
- ECCC-WLA-TC-06 – Resolved based on Proponent response
- ECCC-WLA-TC-07 – Resolved based on Proponent response
- ECCC-WLA-TC-08 – Resolved based on Proponent response
- ECCC Hydrodynamic Model Comment 1 – Resolved based on commitment 6
- ECCC Hydrodynamic Model Comment 2 – Resolved based on Proponent response
- ECCC Hydrodynamic Model Comment 3 – Resolved based on commitment 6
- ECCC Hydrodynamic Model Comment 4 – Resolved based on commitment 6
- ECCC Hydrodynamic Model Comment 5 – Resolved based on Proponent response
- ECCC Hydrodynamic Model Comment 6 – Resolved based on commitment 6

In subsection 4.1, ECCC provides a summary of our comments on the Proponent's response to ECCC-WLA-TC-02, which ECCC considers conditionally resolved based on the Proponent's responses and the Proponent's commitment to undertake an infill geotechnical characterization at the TSF and further testing including percolation testing and hydraulic conductivity testing prior to construction of the TSF.

ECCC also conducted a technical review of the information provided in the *Effluent Quality Criteria Report for Effluent Discharged from Tailings Facilities, Tailings Storage Facilities, or Reservoirs – Version 1* submitted to the NWB on May 27, 2021. In subsections 4.2-4.5, ECCC provides four outstanding comments based on this review.

4.1 ECCC #1 - ECCC-WLA-TC-02: Tailings Storage Facility

References

Responses to WL Amendment IRs-IMLE, Attachment IR-D (5.2.3 Seepage Analysis)

Responses to WL Amendment TCs-IMLE

Previous ECCC Comment/Recommendation (January 29, 2021)

ECCC noted that the 2-3m bedrock fracture zone found during the 2015 drill program is of potential concern, depending on how fractured and altered the bedrock fracture zone is. From the description provided by the Proponent (Responses to WL Amendment IRs, Attachment IR-D), it appears that the bedrock fracture zone may be highly fractured and could be a major conduit pathway for water. The mitigation of bulk fill will not prevent the flow of water through the bedrock fracture zone because the fracture zone connects to a recharge source and may be permeable enough to allow flows. It is also not clear whether the Proponent intends to seal off the fracture zone completely using grout. Bulk fill alone may not be enough to prevent flow through the zone.

ECCC acknowledged the Proponent intends to complete "*Packer testing… in select drillholes to evaluate bedrock hydraulic conductivity*." However, it is unclear whether bedrock hydraulic conductivity test will provide a determination of the hydraulic conductivity of the 2-3m fracture zone in order to assess the rate of flow through the fracture zone.

ECCC requested the Proponent:

- Provide clarification on whether the packer testing will provide a determination of the hydraulic conductivity of the 2-3m fracture zone.

- Provide additional information on how the bulk fill will prevent flow through the 2-3m fracture zone.

Proponent Response

In their response, the Proponent acknowledged ECCC's request and confirms that Sabina is committed to complete an infill geotechnical characterization program at the Tailings Storage Facility (TSF) as outlined in Part D, Item 4 of the Type A Water Licence (2AM-BRP1831). The information from the field characterization will ensure that the design meets the required intent of managing seepage through both the foundation and the body of the TSF Dam.

Furthermore, in technical comment response, WT-INAC-TRC-17, the Proponent noted that they will conduct percolation testing immediately prior to Tailings Storage Facility (TSF) Dam construction prior to excavating the key trench for the TSF Containment Dam. This is a series of shallow drillholes (approximately 10m deep) that will be completed using a blast hole drill at close spacing (about 25m) along both the upstream and downstream extent of the key trench. Then a falling head hydraulic conductivity test will be completed on each drill hole, using heated water if conditions require it.

ECCC Comment/Recommendation

ECCC is satisfied with this response, and awaits the results of the further testing by the Proponent to be completed prior to the construction of the tailings storage facility.

4.2 ECCC #2 – Proposed Effluent Quality Criteria – Nitrate

References

Aquatic Baseline Synthesis Report

CCME Nitrate Ion Factsheet

CCME Water Quality Guidelines for Protection of Aquatic Life

Effluent Quality Criteria Report for Effluent Discharged from Tailings Facilities, Tailings Storage Facilities, or Reservoirs

Proponent's Conclusion

The Proponent has provided proposed effluent quality criteria (EQC) for use during mine operations. This includes a proposed EQC for nitrate of 60 mg/L (maximum authorized monthly mean) with a maximum authorized concentration in a grab sample of 120 mg/L. The rationale provided for development of this limit is that modelling suggests that if predicted maximum nitrate concentrations in effluent were discharged from the Primary Pond, predicted maximum concentrations of nitrate in Goose Lake would be greater than the Canadian Council of Ministers of the Environment (CCME) chronic water quality guideline for nitrate. It is stated that with a discharge concentration of 60 mg/L, nitrate concentrations in Goose Lake would remain below water quality guidelines for nitrate.

ECCC's Conclusion

Although discharge at these nitrate concentrations would result in nitrate concentrations in Goose Lake remaining below CCME water quality guidelines, this still represents a significant increase from the baseline nitrate concentrations. The baseline data for Goose Lake suggests that nitrate during open water conditions is often below detection limits, with a maximum measured concentration of 0.024 mgN/L. During the under ice period, concentrations of nitrate range from 0.0076 mgN/L to 0.094 mgN/L. The water quality guidelines selected for analysis of EQC include the generic CCME water quality guideline for the protection of aquatic life when hardness concentrations are less than 26 mg/L as $CaCO_3$, and the hardness-dependent Site-Specific Water Quality Objectives (SSWQO) developed for the Ekati Diamond Mine when concentrations are between 26.4 and 94 mg/L $CaCO_3$. The CCME and SSWQO guidelines selected for analysis results in a receiving environment guideline concentration ranging from 2.93-10 mgN/L. While the receiving environment guidelines are intended to protect

against direct toxicity to aquatic life, the guidelines do not consider indirect effects to aquatic life due to nutrient enrichment. With increasing concentrations of nitrate in the aquatic environment there is an increased risk of eutrophication, algal blooms, decrease in overall water quality, and alteration of the plankton and benthic invertebrate community composition. Given the baseline nutrient concentrations, increases in nitrate of this magnitude may result in chronic impacts to sensitive species within the immediate receiving environment as well as impacts to water quality due to nutrient enrichment.

While predictions indicate that Goose Lake will remain below CCME guidelines, given the potential change from baseline nitrate concentrations, and the uncertainty of other nutrient inputs, additional analysis should be completed on the potential nutrient enrichment impacts of discharges into Goose Lake. Predicted nitrogen inputs to Goose Lake should be reviewed in conjunction with the predicted phosphorus inputs to evaluate the potential for nutrient-related changes to water quality (i.e. eutrophication).

ECCC Recommendation

ECCC recommends that:

- Predicted total phosphorus and nitrogen inputs be reviewed and the potential for eutrophication in Goose Lake evaluated in the context of increasing nitrogen and total phosphorus loadings.

4.3 ECCC #3 – Potential Treatment

References

Effluent Quality Criteria Report for Effluent Discharged from Tailings Facilities, Tailings Storage Facilities, or Reservoirs

Proponent's Conclusion

Table 17 provides a comparison of proposed EQC to predicted effluent concentrations in the Primary Pond and Llama Tailings Facility during operations. In the case of some parameters, the predicted maximum concentrations in either the Primary Pond or the Llama Tailings Facility are greater than the proposed EQC. The Proponent has acknowledged that the Project may require water treatment for chloride, nutrients, total aluminum, iron, and zinc.

ECCC's Conclusion

Although it is acknowledged that several parameters may require treatment in order to meet the EQC proposed by the Proponent, no information has been provided on the potential treatment options and the ability to achieve the proposed criteria.

ECCC Recommendation

ECCC recommends that the Proponent provide additional information on candidate treatment technologies which would achieve the proposed EQC for parameters listed in Table 17, and the timelines for implementing treatment.

4.4 ECCC #4 – Monitoring, Action Levels, and Validation of Model Predictions

References

Effluent Quality Criteria Report for Effluent Discharged from Tailings Facilities, Tailings Storage Facilities, or Reservoirs

Proponent's Conclusion

The Proponent has provided EQC based on a combination of expected effluent quality, requirements under *the Metal and Diamond Mining Effluent Regulations* (MDMER), available technology, and maintenance of water quality in Goose Lake below water quality guidelines.

ECCC's Conclusion

For many parameters, the predicted concentrations in the effluent, as well as the predicted concentrations in the receiving environment are dependent on assumptions used in modelling. The modelling suggests that Goose Lake will be protected and concentrations will remain below aquatic life guidelines; however, this should be confirmed through ongoing monitoring. Ongoing analysis should include comparisons of measured data for effluent and water quality to model results to validate the assumptions made during modelling and identify if monitoring trends do not remain within predicted values. In addition, monitoring plans should include establishment of action levels within the receiving environment to detect changes within Goose Lake and serve as an early warning system such that mitigation may be applied in advance of any impacts to Goose Lake.

ECCC Recommendations

ECCC recommends

- The Proponent establish water quality action levels for Goose Lake to detect changes to receiving environment water quality, which would serve as an early warning system for detecting any changes occurring in Goose Lake.
- Upon commencing discharge into Goose Lake, the Proponent should complete model validation, including comparison of measured effluent and water quality data to model predictions such that the model may be adjusted accordingly. These comparisons and analyses, including any model updates, should be included in the annual report.

4.5 ECCC #5 – Aluminum Site Specific Water Quality Objective

References

Effluent Quality Criteria Report for Effluent Discharged from Tailings Facilities, Tailings Storage Facilities, or Reservoirs – Section 3.2 (Total Aluminum)

Proponent's Conclusion

The current aluminum chronic water quality guideline used for the Project is the CCME pH-dependent water quality guideline for protection of aquatic life. However, the Proponent has proposed using a modified version of the US EPA (2018) aluminum water quality criterion as a SSWQO in Goose Lake.

ECCC's Conclusion

The Proponent states that they have "modified" the US EPA guideline, to create a SSWQO. However, no information has been provided on how the US EPA guideline, which is based on site pH, total hardness, and dissolved organic carbon (DOC), has been modified to create this site-specific water quality objective.

ECCC Recommendation

ECCC recommends the Proponent provide additional information on how the US EPA aluminum water quality guideline has been modified for application to this site.

5.0 Closing Remarks

ECCC acknowledges and appreciates the effort that the Proponent has taken to provide information and address concerns brought forward by parties through the WL Amendment process. ECCC would like to thank NWB for this opportunity to provide input to Sabina Gold & Silver Corp's Back River Project WL amendment review and looks forward to continuing its participation.

ECCC's technical review comments and recommendations are not to be interpreted as any type of acknowledgement, compliance, permission, approval, authorization, or release of liability related to any requirements for the Proponent to comply with federal or territorial statutes and regulations.