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Richard Dwyer

Manager of Licensing
Nunavut Water Board
P.O. Box 119
Gjoa Haven, Nunavut
X0B 1J0

September 26th, 2022

Re: Review of Back River Hydrodynamic and Water Quality Modelling of Goose Lake and Water and Load Balance Report.

Dear Richard Dwyer, the KIA had reviewed Sabina's Back River Hydrodynamic and Water Quality Modelling of Goose Lake and Water and Load Balance Report. Enclosed are our aquatic sciences consultant's comments on the Hydrodynamic and Water Quality Modelling and the Water and Load Balance Report.

Thank you

John Roesch

John Roesch, P.Eng.

Senior Hope Bay Project Officer
Kitikmeot Inuit Association, Department of Lands and Environment

Cc Wynter Kuliktana, Acting Director, KIA, Department of Lands and Environment

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Hydrodynamic and Water Quality Modelling of Goose Lake

KIA-NWB-1

Review Comment Number	KIA-NWB-1.
Subject/Topic	No vertical TDS profile data
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: 4.0 Model Calibration and 4.4 TDS Concentrations Page: 19 of 105
Detailed Review Comment	Observed TDS data is not available for vertical profiles. Therefore, model performance for predicted TDS concentrations was based on similarity in patterns of observed specific conductivity values and predicted TDS concentrations. Given that parameter concentrations are used as indicators to determine the impact the project will have on the receiving environment it is important to assess model performance against observed concentrations and not patterns.
Recommendation/Request	It is recommended that TDS vertical profiles be collected in Goose Lake in the upcoming open water season to further assist with model calibration and evaluate model performance.

KIA-NWB-2

Review Comment Number	KIA-NWB-2.
Subject/Topic	Mixing Zone Incorrectly Identified
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: 7.1 Predicted Concentrations at the Edge of Mixing Zones Page: 28 of 105 Section: Appendix B Goose Lake Model – Timeseries of Predicted Constituent Concentrations at the Edges of Mixing Zones during the Forecast Period Page 47 to 65 of 105
Detailed Review Comment	Sabina states, "*The Goose Lake Model predictions at the edge of mixing zones for each mine-affected inflow (i.e., PN04, PN05, and PN08) are presented in Table 6 and Table 7, and Appendix B (timeseries plots). For PN04 and PN08 mine-affected inflows, the model results were extracted*

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	along an arc located at a radius of approximately 180 to 220 m from the discharge point to Goose Lake. For PN05, model results were extracted along the arc located at a radius of approximately 390 to 440 m, because the mesh cells located within the approximately 200 m radius from the PN05 discharge point did not contain water for the full duration of each year (i.e., the lake is frozen to bottom during winter at these locations) and thus the closest cell with unfrozen water for the entire year was selected to extract results." The CCME[1] defines the physical mixing zone as, "*the area up to the point where there is virtually no measurable difference between receiving water and effluent mixed with receiver*." They also note, "*The size of the physical mixing zone is not fixed but varies over time with factors such as: effluent flow rate and concentration, design of the outfall, ambient properties (depth, velocity, density, etc.), and concentrations of the substances in both the receiving environment and the effluent. Additionally, the size of the physical mixing zones also may differ for each contaminant because the mixing process itself may differ for different parameters*." Given that several parameters exceed the outlined objectives at what Sabina calls the *"edge of the mixing zone"* for mine-affect inflows PN04, PN05 and PN08 indicates that 180 to 220 m for PN04 and PN08 and 390 to 440 m for PN05 are not the mixing zone for several parameters. In addition, Mackenzie Valley Land and Water Board[2] provides guidance specific to northern environments stating, "*for lakes – regulated mixing zones should have a maximum radius of 100 m or 25% of the width of the lake (whichever is smaller), not exceed 10% of the available volume for mixing and not extend closer to shore than the mean low water mark."* Other relevant Nunavut projects that abide by this 100 m mixing zone include the Meliadine project both within the marine

[1] Canadian Council of Ministers of the Environment (CCME), 2008. Technical Supplement 2: Canada-2ide Strategy for the Management of Municipal Wastewater Effluent, Environmental Risk Management Framework and Guidance, June 2008.
[2] Mackenzie Valley Land and Water Board. 2017. Guidelines for Effluent Mixing Zones. Mackenzie Valley Land and Water Board, Gwich'in Land and Water Board, Sahtu Land and Water Board, Wek'èezhìi Land and Water Board, Government of the Northwest Territories. 35 pages.

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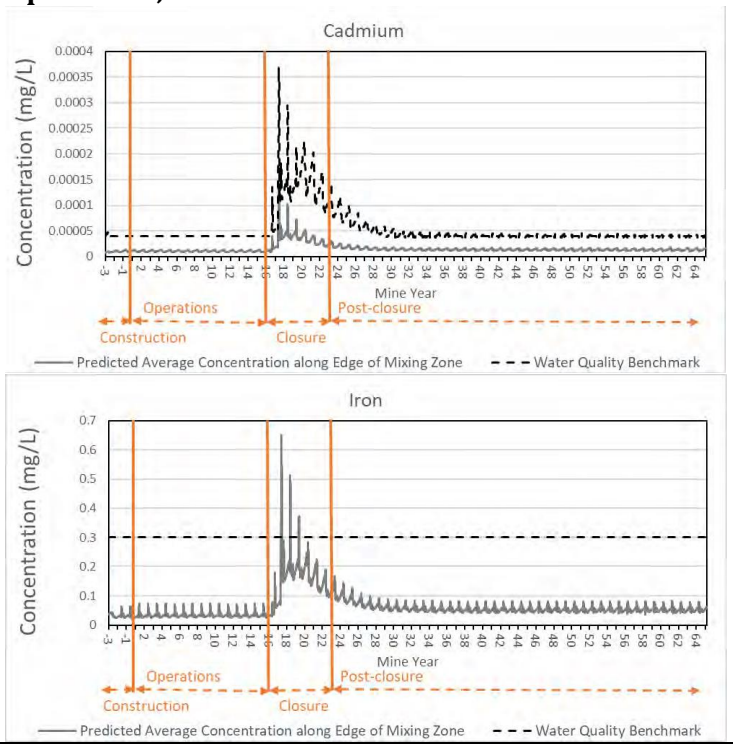
	environment (Melvin Bay[3]) and freshwater environment (Meliadine Lake[4]). Parameters that exceeded benchmarks in the current hydrodynamic model at the edge of Sabina's defined mixing zone include cadmium, iron, nickel, phosphorus, selenium and zinc for PN04. Chloride, iron, nickel, phosphorus and selenium for PN05. Cadmium, chloride, iron, nickel, phosphorus, selenium and zinc for PN08. The following timeseries predicted constituent concentration figures from Appendix B illustrate the exceedance of parameter specific objectives. **Figure B1: Predicted Timeseries Concentration of Water Quality Constituents in Goose Lake at the Edge of Mixing Zone for PN04 over the Construction, Operations, Closure and Post-closure Periods** 

[3] Agnico Eagle 2020. Meliadine Gold Mine – Final Environmental Impact Statement Addendum. Environmental Assessment of Treated Groundwater Effluent Discharge into Marine Environment, Rankin Inlet. 455 pages.
[4] Golder Associates Ltd. 2020. Water Quality Management and Optimization Plan – Implementation Plan for Total Dissolved Solids. 54 pages.

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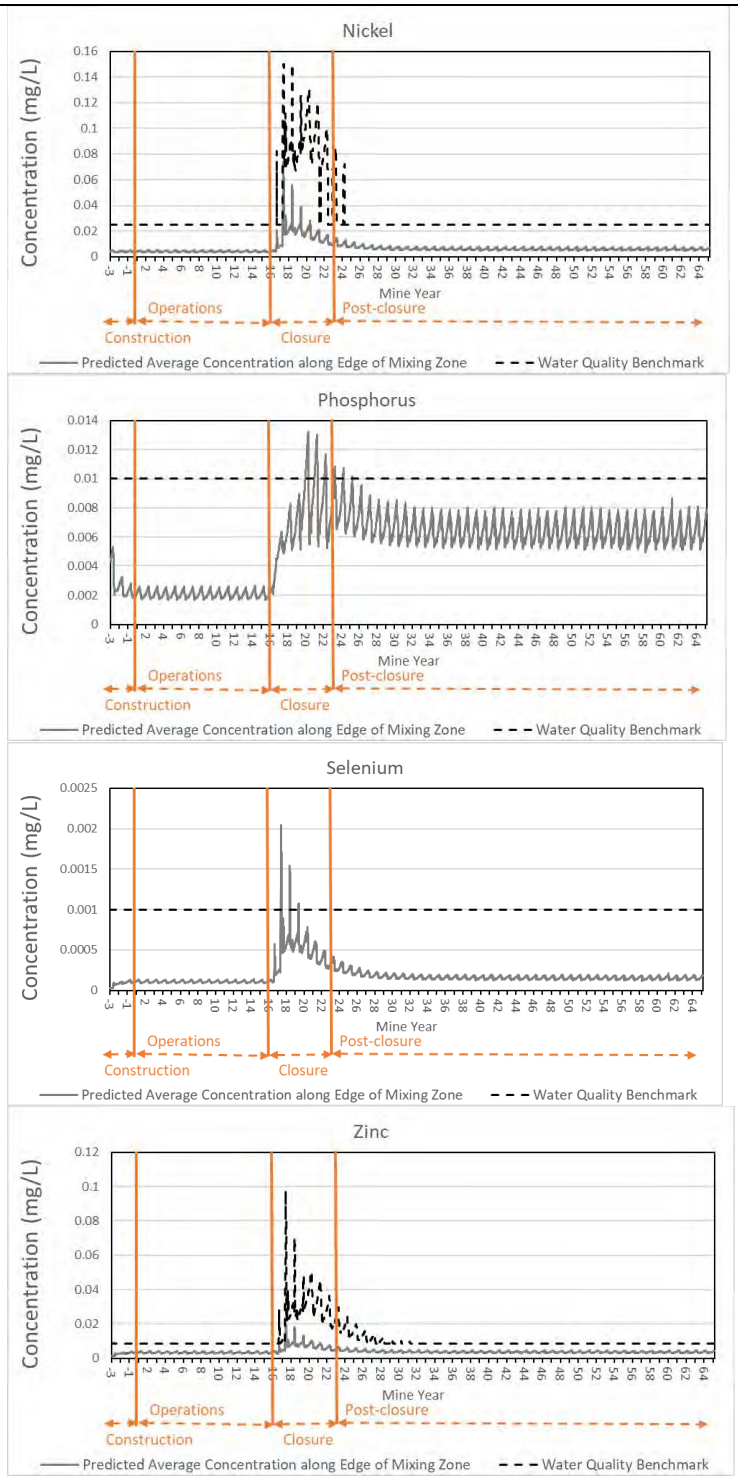

Figure B2: Predicted Timeseries Concentrations of Water Quality Constituents in Goose Lake at the Edge

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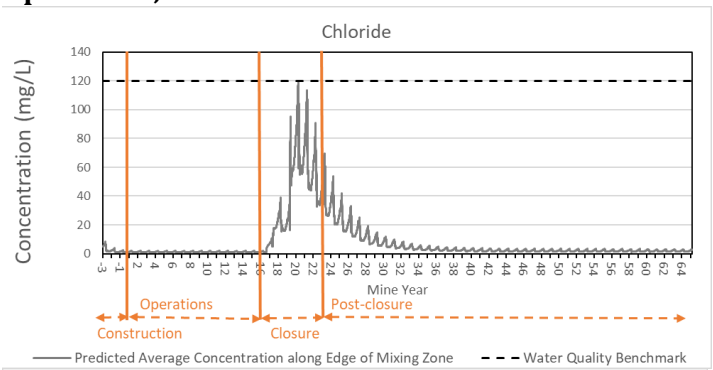
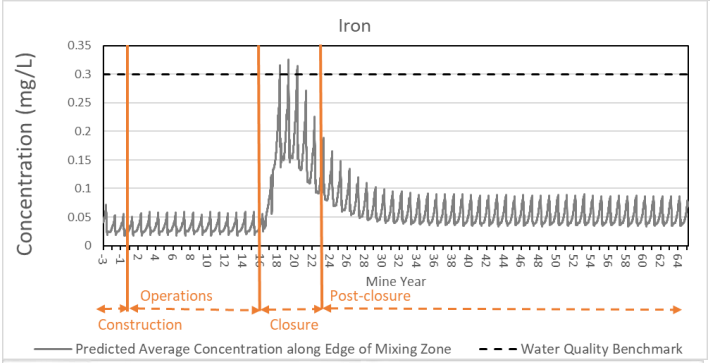
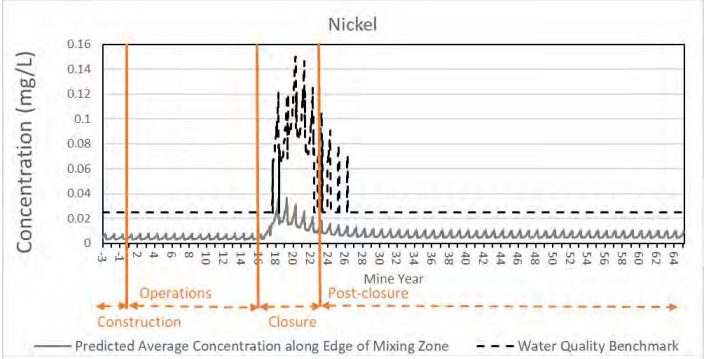
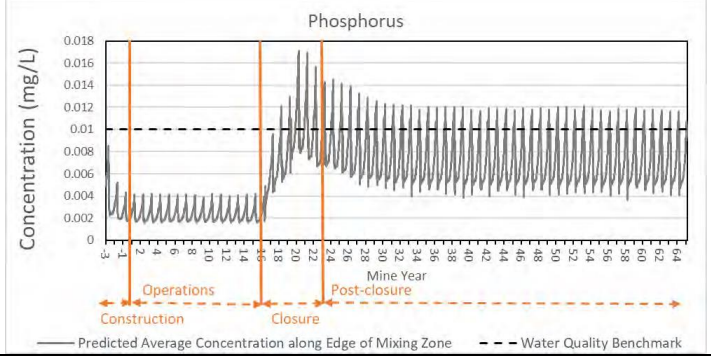
of Mixing Zone for PN05 over the Construction, Operations, Closure and Post-closure Periods









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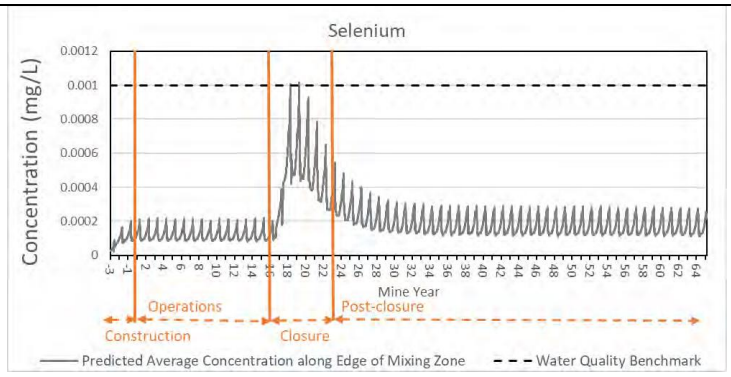
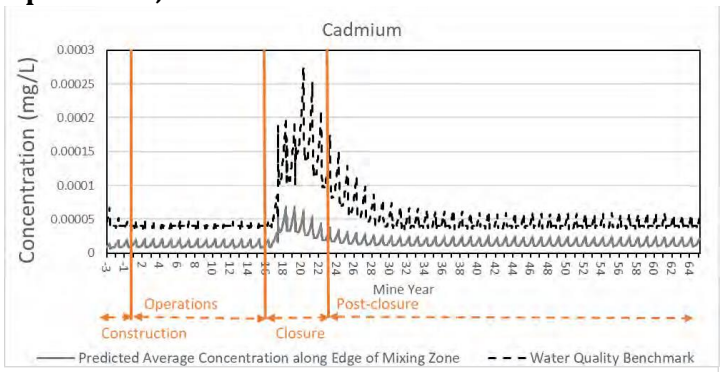
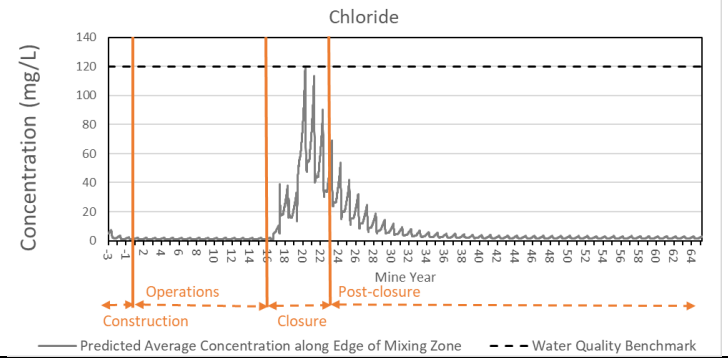


Figure B3: Predicted Timeseries Concentrations of Water Quality Constituents in Goose Lake at the Edge of Mixing Zone for PN08 over the Construction, Operations, Closure and Post-closure Periods





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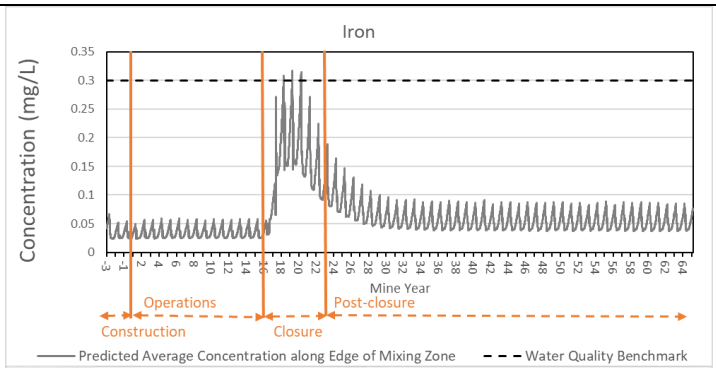

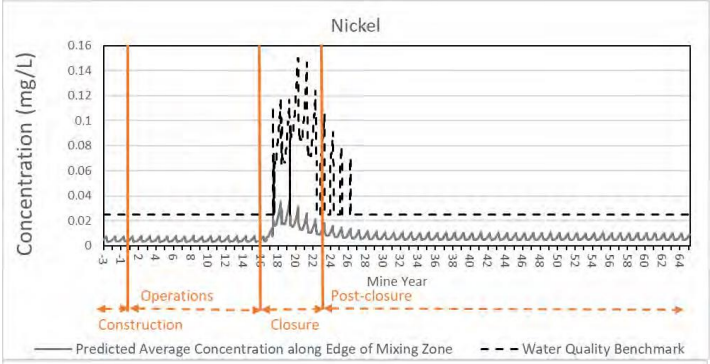

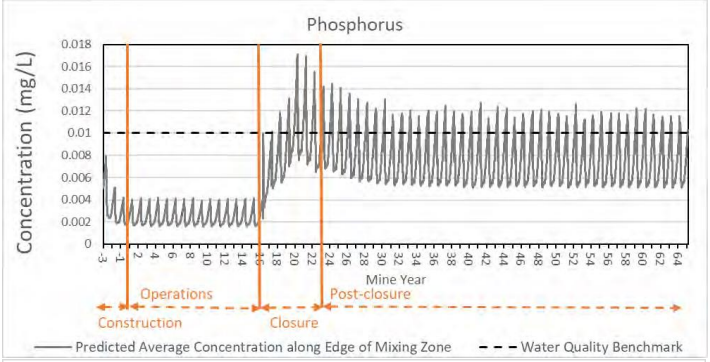

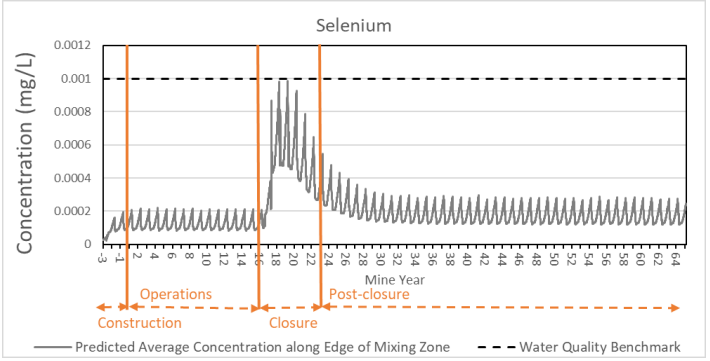

Therefore, the current hydrodynamic model does not abide by the regulated 100 m radius for mixing zones in northern environments and has not properly defined the

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	mixing zone for cadmium, chloride, iron, nickel, phosphorus, selenium and zinc. This presents a more substantial potential risk to aquatic life in Goose Lake.
Recommendation/Request	It is recommended that Sabina determine and commit to implementing mitigation efforts to abide by the 100 m radius for mixing zones in northern environments and provide a model to verify that this regulation can be met.

KIA-NWB-3

Review Comment Number	KIA-NWB-3.
Subject/Topic	Impacts of mine influenced inflow on lake freezing
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: 7.1 Predicted Concentrations at the Edge of Mixing Zones Page: 28 of 105 Section: 8.0 Sensitivity Analysis Page: 35 of 105
Detailed Review Comment	Sabina states, "*The Goose Lake Model predictions at the edge of mixing zones for each mine-affected inflow (i.e., PN04, PN05, and PN08) are presented in Table 6 and Table 7, and Appendix B (timeseries plots). For PN04 and PN08 mine-affected inflows, the model results were extracted along an arc located at a radius of approximately 180 to 220 m from the discharge point to Goose Lake. For PN05, model results were extracted along the arc located at a radius of approximately 390 to 440 m, because the mesh cells located within the approximately 200 m radius from the PN05 discharge point did not contain water for the full duration of each year (i.e., the lake is frozen to bottom during winter at these locations) and thus the closest cell with unfrozen water for the entire year was selected to extract results."* However, Sabina does not indicate whether there may or may not be impacts on lake freezing due to warmer inflows from the mine site or if mine affected inflows will only occur during the open water season in the updated modelled scenario. Furthermore, in the sensitivity scenarios Sabina only provides Lake Outlet timeseries data for the open water season, "*since there is no outflow from the lake during the ice cover season."* If there is the potential for mine-affect

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	inflows to impact the freeze thaw patterns of Goose Lake, then the sensitivity analysis should be updated to include the ice-covered season.
Recommendation/Request	It is recommended that Sabina discuss the potential impacts on lake freezing resulting from mine affected inflows to Goose Lake or clarify if mine affected inflows will only occur during the open water season. If mine-affected inflows may impact the freeze thaw patterns in Goose Lake than it is recommended that the sensitivity analysis be updated to include the ice-covered season.

KIA-NWB-4

Review Comment Number	KIA-NWB-4.
Subject/Topic	Inappropriate phosphorus aquatic water quality guideline
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: 2.3 Modelled Constituents and Screening Criteria Table 1: Modelled Constituents and Surface Water Quality Effects Benchmarks for the Protection of Aquatic Life Page: 8 and 9 of 105 Back River Project Final Environmental Impact Statement Supporting Volume 6: Freshwater Environment Appendix V6-3A Page 155 of 920
Detailed Review Comment	Sabina used a water quality benchmark of 0.01 mg/L for phosphorus stating, "*This value is the upper limit of the oligotrophic range (CCME 2004) to maintain the current trophic status of Goose Lake (Golder 2019).*" However, according to the Back River Project baseline report Goose Neck, Goose Central and Goose Tail were all considered ultraoligotrophic with phosphorus concentration below 0.004 mg/L (see Table 3.2-1 below). Given the current trophic status of Goose Lake at all evaluated locations is classified as ultraoligotrophic, the water quality benchmark should be <0.004 mg/L following CCME[5] guidance to maintain the existing trophic status. This is further corroborated by the 50th percentile background concentration of 0.0037 mg/L and 0.0034 mg/L for the entire lake provided in Table 6 and Table 8, respectively. The current benchmark reflects a different trophic status

[5] Canadian Council of Ministers of the Environment (CCME). 2004. Canadian water quality guidelines for the protection of aquatic life: Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems. In: Canadian environmental quality guidelines, 2004, Canadian Council of Ministers of the Environment, Winnipeg.

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	and would permit an increase in nutrients which could result in a more productive lake. Table 3.2-1. Lake Water Quality, Percent of Samples in which Concentrations are Higher than CCME Guidelines, Back River Project, 2011 Lake | Total Number of Samples Collected | CCME Guideline Value[a] | pH 6.5-9.0 | Ammonia (as N) temperature- and pH-dependent | Fluoride (F) 0.12[b] mg/L | Chloride (Cl) 640 mg/L | Nitrate (as N) 2.935[b] mg/L | Nitrite (as N) 0.06 mg/L | Total Phosphorus Trophic Status[c] | Free Cyanide 0.005 mg/L Llama 2 0 0 0 0 0 0 Ultraoligotrophic 0 Umwelt 2 0 0 0 0 0 0 Oligotrophic - mesotrophic 0 Giraffe 3 0 0 0 0 0 0 Ultraoligotrophic 0 Goose Neck 3 0 0 0 0 0 0 Ultraoligotrophic 0 Goose Central 3 0 0 0 0 0 0 Ultraoligotrophic 0 Goose Tail 1 100 0 0 0 0 0 Ultraoligotrophic 0 Propellor 1 0 0 0 0 0 0 Ultraoligotrophic - Oligotrophic 0 Reference 8 5 0 0 0 0 0 0 Ultraoligotrophic - Oligotrophic 0 Total 28
Recommendation/Request	It is recommended that Sabina update their phosphorus water quality benchmark for phosphorus from 0.01 mg/L to <0.004 mg/L to reflect the current trophic status of Goose Lake. Alternatively, Sabina may provide updated baseline water quality data (i.e., up to and including the most recent monitoring year) for Goose Lake to substantiate the use of a higher water quality benchmark. Sabina should be sure to follow the CCME[6] Guidance Manual for Developing Nutrient Guidelines and propose mitigations to maintain the existing trophic status in Goose Lake when discharges occur if required.

KIA-NWB-5

Review Comment Number	KIA-NWB-5.
Subject/Topic	Permanent Increase in Phosphorus Concentrations
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: Appendix B Goose Lake Model – Timeseries of Predicted Constituent Concentrations at the Edges of Mixing Zones during the Forecast Period Section: Appendix C Goose Lake Model – Timeseries of Predicted Constituent Concentrations at the Assessment Stations during the Forecast Period Page 53, 59, 65, 73, 79, 85
Detailed Review Comment	Phosphorus concentrations are predicted to increase during the closure period in Goose Lake (all sites included in the hydrodynamic model) and remain elevated in perpetuity. It represents a shift in trophic status from ultra-oligotrophic (phosphorus concentrations <0.004 mg/L) to oligotrophic (phosphorus concentrations between 0.004 mg/L and 0.01 mg/L). This could have a significant impact on the phytoplankton and macrophyte community including increases or shifts in composition which may subsequently impact higher trophic levels.

[6] Canadian Council of Ministers of the Environment (CCME). 2016. Guidance manual for developing nutrient guidelines for rivers and streams.

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Figure B1: Predicted Timeseries Concentration of Water Quality Constituents in Goose Lake at the Edge of Mixing Zone for PN04 over the Construction, Operations, Closure and Post-closure Periods

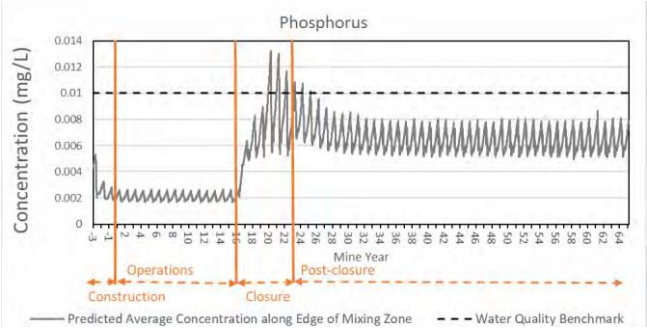

Figure B2: Predicted Timeseries Concentrations of Water Quality Constituents in Goose Lake at the Edge of Mixing Zone for PN05 over the Construction, Operations, Closure and Post-closure Periods

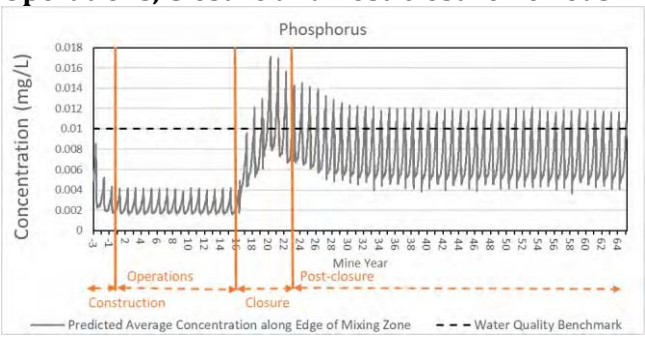

Figure B3: Predicted Timeseries Concentrations of Water Quality Constituents in Goose Lake at the Edge of Mixing Zone for PN08 over the Construction, Operations, Closure and Post-closure Periods

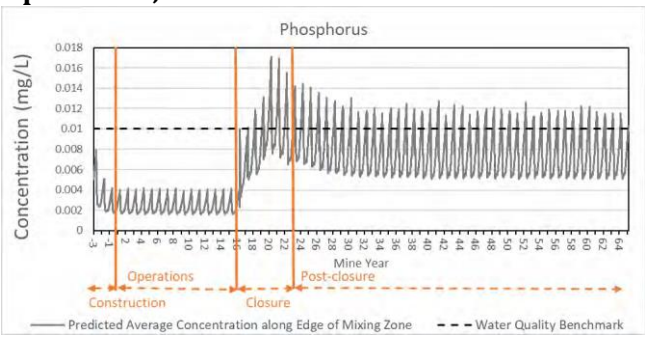

Figure C1: Predicted Timeseries Concentrations of Water Quality Constituents in Goose Lake at GLCB over the Construction, Operations, Closure and Post-closure Periods

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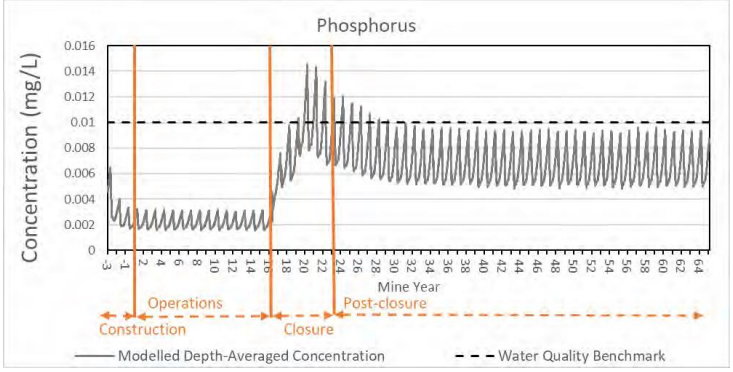


Figure C2: Predicted Timeseries Concentrations of Water Quality Constituents in Goose Lake at GLTL over the Construction, Operations, Closure and Post-closure Periods

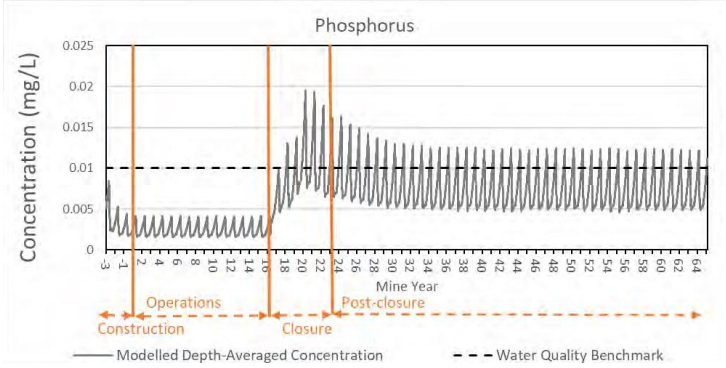
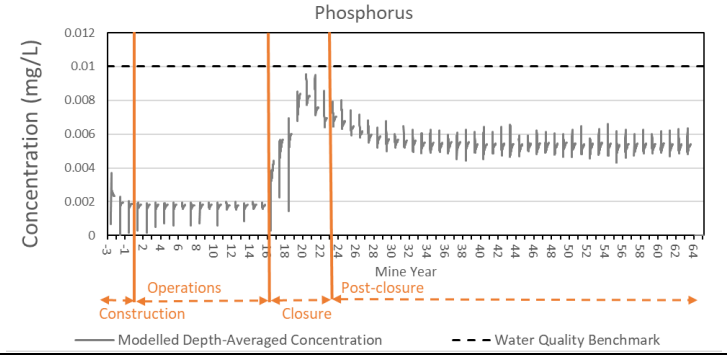


Figure C3: Predicted Timeseries Concentrations of Water Quality Constituents in Goose Lake Outflow over the Construction, Operations, Closure and Post-closure Periods



Recommendation/Request	A shift in trophic status from ultra-oligotrophic to oligotrophic is predicted for Goose Lake. This could have a significant impact on the phytoplankton and macrophyte community including increases or shifts in composition which may subsequently impact higher

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	trophic levels. It is recommended that Sabina propose treatment for mine-affected inflows to Goose Lake as necessary to maintain the current trophic status of the lake. Sabina may also investigate the potential impact increases in phosphorus could have on Goose Lake including changes in phytoplankton community composition and biomass to demonstrate whether minimal impacts may be expected should they wish to maintain the current modeled phosphorus increases.

KIA-NWB-6

Review Comment Number	KIA-NWB-6.
Subject/Topic	Only open water dissolved organic carbon concentrations used in benchmark development
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: 2.3 Modelled Constituents and Screening Criteria Table 1: Modelled Constituents and Surface Water Quality Effects Benchmarks for the Protection of Aquatic Life Page: 9 of 105
Detailed Review Comment	For benchmark development Sabina notes, "*Values of pH and DOC used to calculate pH and DOC-dependent guidelines were based on data collected in Goose Lake during open water conditions (Golder 2019, 2022).*" The reviewer finds this method acceptable for pH, however lower concentrations of dissolved organic carbon (DOC) may be observed during the ice-covered season which would result in lower benchmark concentrations as DOC has an ameliorating effect on several parameters of concern (e.g., zinc). Therefore, DOC concentrations from the ice-covered season should be included in benchmark development.
Recommendation/Request	It is recommended Sabina include dissolved organic carbon (DOC) concentrations measured during the ice-covered season in benchmark development to produce conservative benchmarks that reduce the ameliorative effects of DOC or provide both open-water and ice-covered dissolved organic carbon values and justification for the use of only the open-water season.

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KIA-NWB-7

Review Comment Number	KIA-NWB-7.
Subject/Topic	Climate change consideration
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: 3.2 Meteorological Data Page: 13 of 105 Document: Back River Project Water and Load Balance Report Section: 3.2.2 Climate Change Page: 18 of 110
Detailed Review Comment	Climate change does not appear to be taken into consideration within the hydrodynamic and water quality model. Sabina states, "*The precipitation data were extracted from Lupin station. An estimated under-catch factor was applied to the observed precipitation data based on the under-catch adjustment analysis completed by SRK (2015). For years with large gaps in precipitation data, monthly precipitation data for an average climate year were obtained from the Water and Load Balance (WLB) Model (WSP Golder 2022)*." In the load and water balance model Sabina states, "*A climate change analysis was completed for the Project in 2015 (SRK 2015b) which projected the rate of change in precipitation and temperature in the future on an annual basis. While most surface water management infrastructure will have short lifespans and be breached at Closure, open pits filled with tailings and saline water, and waste rock storage areas will remain in perpetuity and long-term climate change effects were considered. The long-term air temperature and precipitation projections used as inputs to the Model are provided in Table 4, based on trends from 1979 to 2005. Temperature and precipitation projections in the Model were linearly interpolated and centered for 2025, 2055, and 2085, with climate projections beyond 2085 assumed to remain constant*." Climate change models and predictions change as more information becomes available. It is important to include recent projections in climate analysis.

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	Therefore, it is recommended that Sabina clarify if the precipitation data used in the models includes the greater variability in precipitation values that may result from climate change as in described Bush and Lemmen, 2019[7].
Recommendation/Request	It is recommended that Sabina clarify if the precipitation data used in the models includes the greater variability in precipitation values that may result from climate change as in described in Bush and Lemmen, 2019[7].

KIA-NWB-8

Review Comment Number	KIA-NWB-8.
Subject/Topic	Use of temperature data from Snap Lake
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: 3.5 Water Quality Inputs Page: 9 of 105
Detailed Review Comment	For water quality inputs that pertain specifically to temperature Sabina states, *"Continuous measurements of stream water temperature were not available for inflows from natural tributaries; thus, temperature timeseries were developed using data collected at streams draining into Snap Lake collected from 2009 and 2016 (De Beers 2017) and were applied to all tributary inflows to Goose Lake."* The use of temperature data collected at Snap Lake is not appropriate for Goose Lake for several reasons: 1. Goose Lake is substantially further north than Snap Lake. Goose Lake has a latitude of 65°33' and Snap Lake has a latitude of 63°53'. 2. Snap Lake is in an area with a greater coverage of pooling water relative to Goose Lake which would impact thermal regimes in ephemeral flow paths. 3. Snap Lake is close to the tree line compared to Goose Lake which is well above the tree line. Therefore, it is recommended the Sabina collect local thermal data from the natural tributaries or find data from a more appropriate source.
Recommendation/Request	The use of Snap Lake temperature data is inappropriate for input in the hydrodynamic model for Goose Lake due

[7] *Bush, E. and Lemmen, D.S., editors (2019): Canada's Changing Climate Report; Government of Canada, Ottawa, ON. 444 p.*

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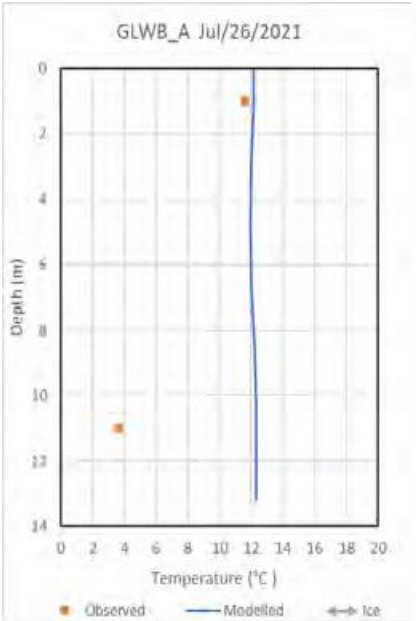
	to difference in latitude, surrounding ephemeral flow paths and proximity to the tree line. Therefore, it is recommended that Sabina collect and use local data from natural tributaries or obtain data from a more appropriate source.

KIA-NWB-9

Review Comment Number	KIA-NWB-9.
Subject/Topic	Thermal stratification
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: Appendix A Goose Lake Model – Calibration Results – Profile Plots Page: 42 of 105
Detailed Review Comment	On July 26, 2021 from station GLWB_A thermal stratification was observed (evidenced by the orange data points) but was not modelled (blue line). Thermal stratification can be an indicator of potential changes in dissolved oxygen and the release of nutrients and metals from the lake sediment. Therefore, it is important to ensure that modeled thermal changes reflect observed. 
Recommendation/Request	It is recommended that Sabina provide an explanation why the model did not capture observed thermal stratification.

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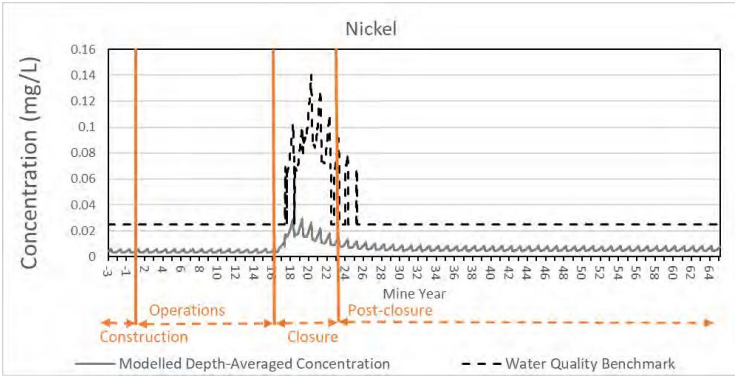
KIA-NWB-10

Review Comment Number	KIA-NWB-10.
Subject/Topic	Multiyear exceedances of nickel, chloride, iron and selenium
Reference	Document: Hydrodynamic and Water Quality Modelling of Goose Lake Section: Appendix C Goose Lake Model – Timeseries of Predicted Constituent Concentrations at the Assessment Stations during the Forecast Period Page:
Detailed Review Comment	The predicted timeseries concentrations for nickel, chloride, iron and selenium at the central basin and tail of Goose Lake indicate multiyear exceedance of chronic guideline of the entire lake, indicating the potential for prolonged deleterious effects to aquatic life. It is recommended that Sabina either prove that the guidelines are overprotective for this particular site or provide mitigation efforts to reduce impacts. While exceedances are acceptable within the mixing zone, whole lake exceedances are not. **Figure C1: Predicted Timeseries Concentrations of Water Quality Constituents in Goose Lake at GLCB over the Construction, Operations, Closure and Post-closure Periods**  **Figure C2: Predicted Timeseries Concentrations of Water Quality Constituents in Goose Lake at GLTL over the Construction, Operations, Closure and Post-closure Periods**

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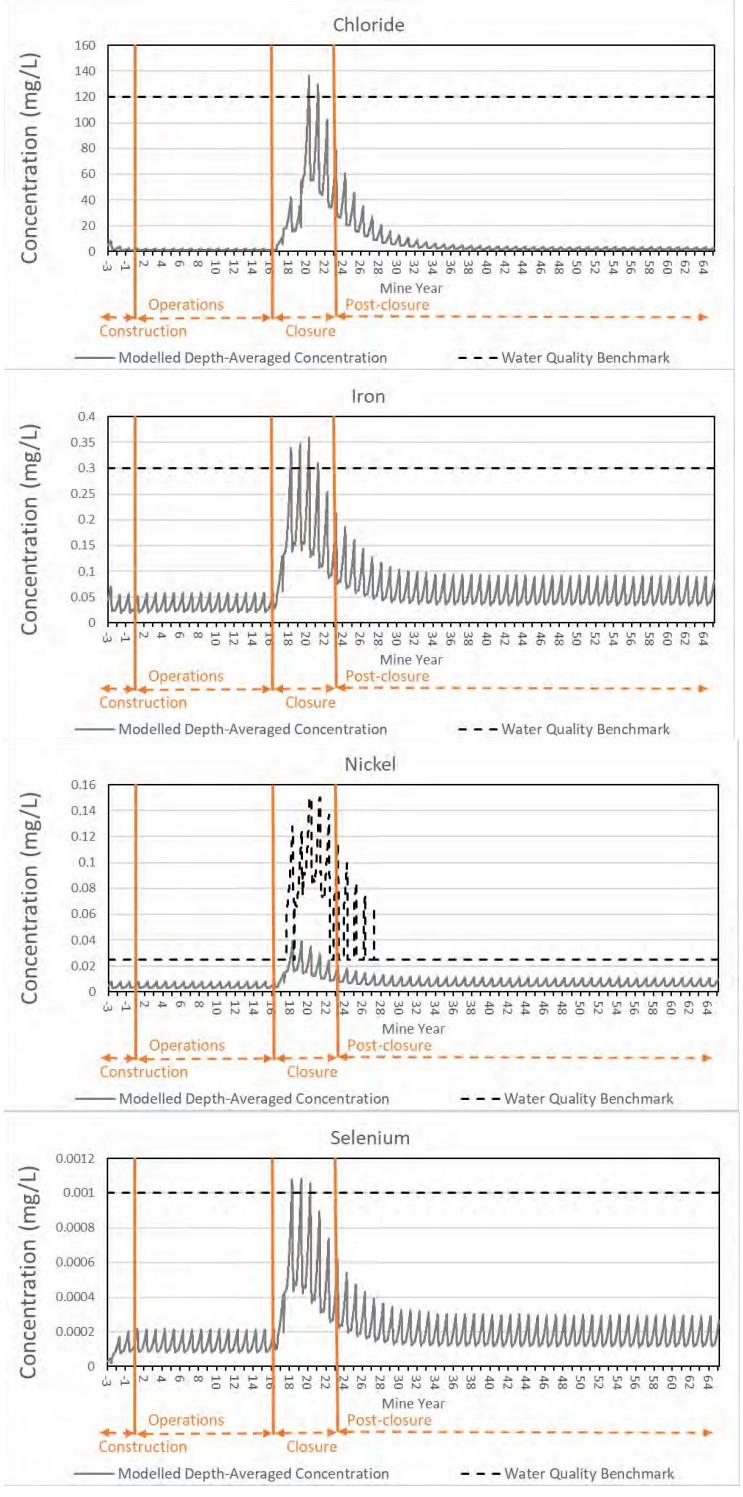

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Recommendation/Request	It is recommended that Sabina either demonstrate that the generic guidelines for nickel, chloride, iron and selenium are overprotective for this particular site (e.g., derive a site-specific water quality objective) or provide mitigation efforts to reduce potential impacts to aquatic life due to multiyear exceedances of chronic guidelines (e.g., provide water treatment when contact water is predicted to result in lake wide exceedances).

Water and Load Balance Report

KIA-NWB-11

Review Comment Number	KIA-NWB-11.
Subject/Topic	Inconsistences in analysis of values below the detection limit
Reference	Document: Back River Project Water and Load Balance Report Section: 4.2.1 Background Surface Water Quality and Lake Initial Water Quality Page: 25 of 110
Detailed Review Comment	Sabina states, "*Golder compiled and analyzed water quality data collected at the Project Site from 2011 to 2018 (Golder 2019). Stream water samples were collected and analyzed during freshet and the remaining open water season. The median concentrations were used as inputs in the load balance component of the Model (APPENDIX D). Measurements below the detection limit were conservatively assumed to be equal to the detection limit, with the exception of mercury which was treated as half the detection limit. Initial concentrations were assigned to Llama and Umwelt lakes in the model based on data collected in 2011 by Rescan (Rescan 2012) (APPENDIX E).*" Sabina does not explain why half the detection limit was used for mercury and not the other parameters. Using half, the detection limit will decrease predicted concentrations of mercury and is not consider a conservative approach to modeling.
Recommendation/Request	It is recommended that Sabina either use the detection limit for mercury values below detection or provide an explanation for the inconsistencies in data analysis.

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KIA-NWB-12

Review Comment Number	KIA-NWB-12.
Subject/Topic	Use of dissolves source concentrations
Reference	Document: Back River Project Water and Load Balance Report Section: 4.2.3 Background Surface Water Quality and Lake Initial Water Quality Page: 26 of 110
Detailed Review Comment	Sabina states, "*Dissolved source concentrations for water in contact with the WRSAs and the Ore Stockpile were developed by SRK (2015), revised by Golder (2020), and further refined by WSP Golder for use in the geochemical modelling used for the load balance component of this model. The approach used to predict the source concentrations used HCT results and included the application of correction factors (i.e., temperature, coarseness, and flow channeling), geochemical modelling, and extrapolation of monitoring data from geologically similar sites in the area.*" The use of dissolved concentrations underpredicts concentrations in contact water and therefore total concentrations of parameters in inflow water to Goose Lake should be used. Depending on the parameter particulate fractions can cause greater impact to aquatic biota than the dissolved fraction therefore, it is important to take both fractions into consideration when predicting parameter concentrations. Sabina also does not clearly state if predicted concentrations are for the total fraction or dissolved. Predicted concentrations could be misleading if these values represent the dissolved fraction and not the total fraction.
Recommendation/Request	It is recommended that Sabina use total source concentrations in future modeling or provide an explanation why dissolved source concentrations are appropriate for use at this site. It is also recommended that Sabina clarify that all output parameters represent total parameter concentrations and not the dissolved fraction.

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KIA-NWB-13

Review Comment Number	KIA-NWB-13.
Subject/Topic	Values only compared to MDMER
Reference	Document: Back River Project Water and Load Balance Report Section: 5.2 Modelled Constituents and Discharge Limits Page: 32 of 110 Section: 7.1 Prediction Nodes Page 46 of 110
Detailed Review Comment	Sabina states, "Water quality constituents included in the load balance component of the Model are listed in Table 18. Results of the load balance component of the Model were screened against the Metal and Diamond Mining Effluent Regulations (MDMER) discharge limits (Government of Canada 2002) (Table 19). It is acknowledged that additional requirements for discharge limits may be applicable (e.g., Water Licence discharge limits) to meet intake (i.e., Goose Lake) water quality objectives." Discharges must meet all discharge limits including MDMER, licence criteria and acute guidelines (site specific or generic), however Sabina has only compared discharges to MDMER. Therefore, it is recommended that Sabina compare results of the load balance to MDMER, licence criteria and acute guidelines (site specific or generic). Sabina also states, "*Timeseries plots of the predicted monthly average constituent concentrations (i.e., under average climate conditions; Section 5.1.3) (APPENDIX F). These plots are presented for the constituents with MDMER discharge limits and those that were included in the Goose Lake Hydrodynamic Model (WSP Golder 2022).*" Given that other additional discharge limits are applicable timeseries plots should be updated to include all constituents with licence criteria and acute guidelines.
Recommendation/Request	It is recommended that Sabina compare results of the load balance to all applicable criteria including MDMER, licence criteria and acute guidelines to provide confidence discharge will be compliant and provide timeseries plots for all constituents with discharge limits.

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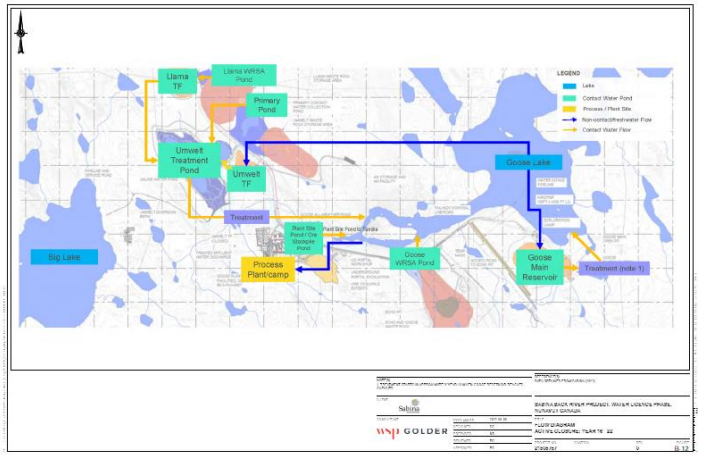
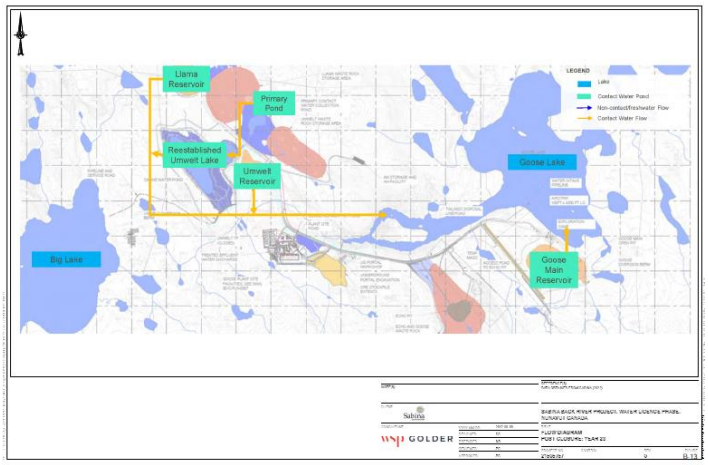
KIA-NWB-14

Review Comment Number	KIA-NWB-14.
Subject/Topic	Discharge of treated contact water at north side of Goose Neck
Reference	Document: Back River Project Water and Load Balance Report Section: Appendix B Page: 69 and 70 of 110
Detailed Review Comment	Figure B12 and B13 show treated contact water being discharge to the northern arm of Goose neck in Goose Lake. This Location does not have a node that was accessed. To determine the impact of treated discharge water being discharge to this location of the lake modeling should be complete and outputs compared to MDMER and all discharge limits specific to the Back River project.  

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Recommendation/Request	It is recommended that Sabina include a modeled node at the northern arm of Goose Neck in Goose Lake in the Load and Water Balance Model and Hydrodynamic model and compare the results to all applicable discharge and benchmark to determine the impact of treated discharge water to this location as or clarify if treated contact water will actually be discharge to this location as indicated in Figures B-12 and B-13. Alternatively, Sabina may provide evidence that this area is non fish bearing / not considered aquatic habitat.

KIA-NWB-15

Review Comment Number	KIA-NWB-15.
Subject/Topic	Nitrate missing from timeseries plots
Reference	Document: Back River Project Water and Load Balance Report Section: Appendix F Timeseries of Predicted Monthly Average Constituent Concentrations at the Prediction Nodes Under Average Hydrological Conditions Page: 84 to 104 of 110
Detailed Review Comment	Nitrate was not included in the timeseries plots. Nitrate is a parameter of concern with an associated site-specific water quality objective. Therefore, it is important to understand how nitrate concentrations are predicted to change over the life of the mine.
Recommendation/Request	It is recommended that Sabina include nitrate in their timeseries plots as it is a parameter of concern with an associated site-specific water quality objective.

KIA-NWB-16

Review Comment Number	KIA-NWB-16.
Subject/Topic	Compare maximum monthly average concentrations to MDMER
Reference	Document: Back River Project Water and Load Balance Report Section: Appendix G Predicted Maximum Monthly Average Concentrations per Mine Phase at Each Prediction Node for Average Hydrological Conditions Page: 105 to 106 of 110
Detailed Review Comment	Maximum monthly average concentrations are provided in appendix G however these values are not compared to MDMER. To provide context and to ensure

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	concentrations are complying it is recommended that Sabina compare values to MDMER and all applicable discharge limits.
Recommendation/Request	It is recommended that Sabina compare maximum monthly average concentrations to MDMER and all applicable discharge limits.