BACK RIVER PROJECT

B2GOLD NUNAVUT-
AEMP UPDATE COMMENT
RESPONSES DOCUMENT

DATE
[21 May 2025]

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ACRONYMS AND ABBREVIATIONS

B2Gold	B2Gold Back River Corp.
NU	Nunavut

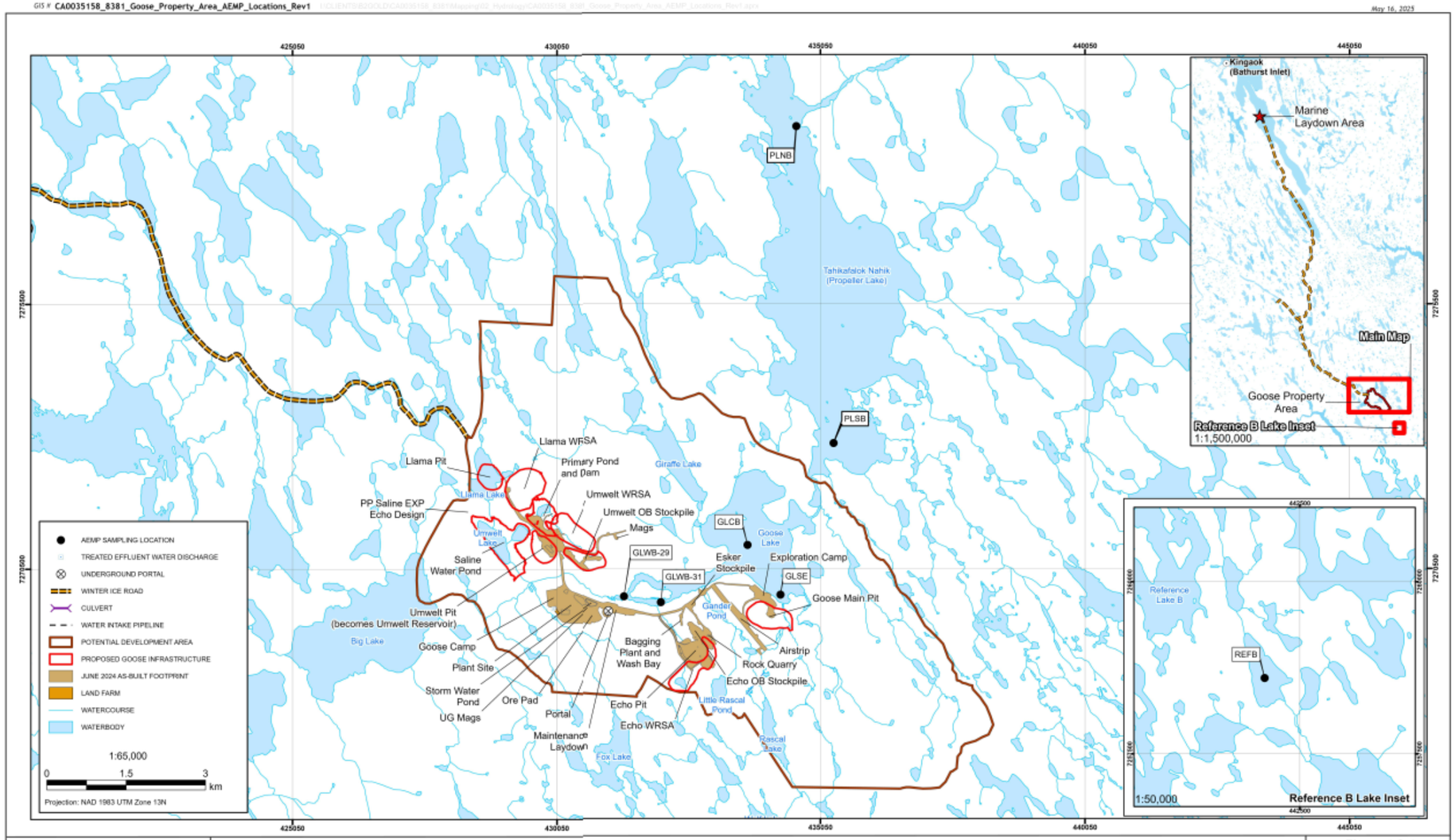
1. B2GOLD RESPONSES TO REVIEWER COMMENTS ON THE AQUATIC EFFECTS MANAGEMENT PLAN

1.1 KITIKMEOT INUIT ASSOCIATION

1.1.1 KIA-NWB-01

Review Comment Number	KIA-NWB-01
Subject/Topic	Umwelt Lake/Umwelt Reservoir
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Sections 2.2, 2.3, 3.2, 3.5, etc.; Figure 4.2-1
Detailed Review Comment	Umwelt Lake/Umwelt Reservoir is referenced several times throughout the AEMP document, but its location is not clear from the map.
Recommendation/ Request	The map should include Umwelt Lake and/or Umwelt Reservoir.
Importance	Low
B2Gold Nunavut Response	Figure 4.2-1 was updated to include a label for Umwelt Lake (under the Saline Water Pond) and Umwelt Reservoir (Umwelt Pit will become Umwelt Reservoir).

Figure 4.2-1: AEMP Sampling Locations Goose Property Area, Back River Project



1.1.2 KIA-NWB-02

Review Comment Number	KIA-NWB-02
Subject/Topic	Baseline Data
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831, Section 4.2.1
Detailed Review Comment	Baseline data is described/discussed but it is not clear exactly how much baseline data exists for each site and AEMP component.
Recommendation/ Request	Please include a table that summarizes the baseline data (# samples per site per parameter/AEMP component, years sampled, etc.).
Importance	High
B2Gold Nunavut Response	The Aquatic Baseline Synthesis Report provided summary tables of baseline data collected between 2010 and 2018. As discussed in Section 4.2.1, more baseline data were collected between 2021 and 2024 to address data gaps identified in the Aquatic Baseline Synthesis Report and to satisfy commitments for additional baseline data. Summaries of the available data collected to date that will be used to support the AEMP are provided in Tables KIA-NWB-02-01 to KIA-NWB-02-05.

Table KIA-NWB-02-1: Available Baseline Water Quality Data

Year	Lakes	Sampling Area	Parameters	Number of Water Quality Samples			
				Under-ice	Open-water		
				April	July	August	September
2010	Reference B Lake	REFB	Conventional parameters, major ions, nutrients, total and dissolved metals	-	-	2	-
2011	Goose Lake Propeller Lake Reference B Lake	GLWB	Conventional parameters, major ions, nutrients, chlorophyll *a* (OW only), total and dissolved metals	1	-	1	-
		GLCB		2	-	1	-
		PLSB		2	-	2	-
		REFB		2	-	1	-
2012	Goose Lake Propeller Lake	GLWB	Conventional parameters, major ions, nutrients chlorophyll *a*, total and dissolved metals, cyanides	1	-	1	-
		GLCB		1	-	1	-
		GLTL		2	-	-	-
		PLSB		2	-	2	-
2013	Goose Lake Propeller Lake Reference B Lake	GLWB	Conventional parameters, major ions, nutrients, chlorophyll *a*, total and dissolved metals, cyanides	1	1	-	-
		GLCB		1	1	-	-
		GLTL		2	-	-	-
		GLSE		-	1	-	-
		PLSB		-	2	-	-
		REFB		1	1	-	-
2015	Propeller Lake	PLSB	Conventional parameters, major ions, nutrients, total and dissolved metals, cyanides	-	-	2	-
		PLNB		-	-	2	-
2017	Goose Lake Reference B Lake	GLWB	Conventional parameters, major ions, nutrients, chlorophyll *a* (OW only), total and dissolved metals, cyanides	-	-	5	5
		GLCB		-	-	5	-
		GLSE		-	-	3	-
		REFB		-	-	5	5
2018	Goose Lake Reference B Lake	GLWB	Conventional parameters, major ions, nutrients, chlorophyll *a*, total and dissolved metals, cyanides, Radium-226 (OW only)	5	10	10	10
		GLCB		5	-	5	-
		GLSE		5	-	5	-
		REFB		5	5	5	5
2021	Goose Lake Propeller Lake Reference B Lake	GLWB	Conventional parameters, major ions, nutrients, chlorophyll *a* (OW only), total and dissolved metals, cyanides	5	2	-	-
		GLCB		6	2	-	-
		GLSE		5	2	-	-
		GLTL		2	2	-	-
		PLSB		5	-	5	-

Year	Lakes	Sampling Area	Parameters	Number of Water Quality Samples			
				Under-ice	Open-water		
				April	July	August	September
		PLNB		-	-	5	-
		REFB		5	-	-	-
2022	Goose Lake Propeller Lake Reference B Lake	GLWB	Conventional parameters, major ions, nutrients, total and dissolved metals, cyanides, Radium-226 (OW only)	8	-	5	-
		GLCB		6	-	5	-
		GLSE		2	-	5	-
		GLTL		2	-	-	-
		PLSB		5	-	5	-
		PLNB		5	-	5	-
		REFB		5	-	5	-
2023	Goose Lake	GLWB	Conventional parameters, major ions, nutrients, total and dissolved metals, cyanides	-	3	-	3
		GLCB		-	3	-	3
		GLSE		-	3	-	3
		GLTL		-	3	-	3
2024	Goose Lake Reference B Lake	GLWB	Conventional parameters, major ions, nutrients, chlorophyll *a* (OW only), total and dissolved metals, cyanides, Radium-226 (OW only)	8		5	5
		GLCB		8	-	5	5
		GLSE		3	-	-	-
		GLTL		3	-	-	-
		REFB		5	5	-	5
Total				126	46	108	52

Notes:

GLWB = Goose Lake West Bay; GLCB =Goose Lake Central Basin; GLSE = Goose Lake Southeast Basin; GLTL = Goose Lake Tail; REFB = Reference B Lake; PLSB = Propeller Lake South Basin; PLNB = Propeller Lake North Basin; "-" = not sampled; OW = open-water.

Table KIA-NWB-02-2: Available Baseline Sediment Quality Data

Year	Lakes	Sampling Area	Parameters	Number of Sediment Samples	
				July	August
2010	Reference B Lake	REFB	pH, total alkalinity, particle size and moisture, carbon and nitrogen content, and metals	-	6
2011	Goose Lake	GLWB	pH, cyanides, particle size and moisture, carbon and nitrogen content, and metals	-	3
		GLCB		-	3
		GLTL		-	3
2012	Goose Lake Propeller Lake	GLWB	pH, cyanides, particle size and moisture, carbon and nitrogen content, metals	-	3
		GLCB		-	3
		GLTL		-	3
		PLSB		-	3
2013	Goose Lake Propeller Lake Reference B Lake	GLWB	pH, cyanides, particle size and moisture, carbon and nitrogen content, metals	3	-
		GLCB		3	-
		GLTL		3	-
		PLSB		3	-
		REFB		3	-
2017	Goose Lake Reference B Lake	GLWB	pH, particle size and moisture, total organic carbon, total nitrogen, metals	-	5
		GLCB		-	5
		GLSE		-	3
		REFB		-	5
2018	Goose Lake Reference B Lake	GLWB	pH, particle size and moisture, total organic carbon, total nitrogen, metals	-	11
		GLCB		-	5
		GLSE		-	5
		REFB		-	5
2021	Propeller Lake	PLSB	Particle size and moisture, nutrients, metals	5	5
		PLNB		5	5
Total				25	81

Notes:

GLWB = Goose Lake West Bay; GLCB =Goose Lake Central Basin; GLSE = Goose Lake Southeast Basin; GLTL = Goose Lake Tail; REFB = Reference B Lake; PLSB = Propeller Lake South Basin; PLNB = Propeller Lake North Basin; "-" = not sampled.

Table KIA-NWB-02-3: Available Baseline Benthic Invertebrate Community Data

Year	Lakes	Sampling Area	Number of Benthic Invertebrate Community Samples	
			July	August
2011	Goose Lake Reference B Lake	GLWB	-	5
		GLCB	-	5
		REFB	-	5
2012	Goose Lake Propeller Lake	GLWB	-	5
		GLCB	-	5
		PLSB	-	5
2013	Goose Lake Propeller Lake Reference B Lake	GLWB	3	-
		GLCB	3	-
		PLSB	3	-
		REFB	3	-
2017	Goose Lake Reference B Lake	GLWB	-	5
		GLCB	-	5
		GLSE	-	3
		REFB	-	5
2018	Goose Lake Reference B Lake	GLWB	-	5
		GLCB	-	5
		GLSE	-	5
		REFB		5
2021	Propeller Lake	PLSB	-	5
		PLNB	-	5
Total			12	78

Notes:

GLWB = Goose Lake West Bay; GLCB =Goose Lake Central Basin; GLSE = Goose Lake Southeast Basin; REFB = Reference B Lake; PLSB = Propeller Lake South Basin; PLNB = Propeller Lake North Basin; "-" = not sampled.

Table KIA-NWB-02-4: Available Baseline Fish Health Data

Year	Sampling Lake/Area	Species	FC = Fish Community Data	FH = Fish Health Data
2010	Reference B Lake	Lake Trout	10	-
2011	Goose Lake	Lake Trout	-	6
	Reference B Lake		-	7
2012	Goose Lake West Bay	Slimy Sculpin	4	-
	Goose Lake Southeast Basin			-
	Goose Lake	Lake Trout	1	5
	Reference B Lake		-	15
2013	Goose Lake West Bay	Slimy Sculpin	-	41
	Goose Lake Southeast Basin		-	
	Propeller Lake	Slimy Sculpin	2	36
		Lake Trout	18	-
	Reference B Lake	Slimy Sculpin	-	33
		Lake Trout	8	-
	Goose Lake	Lake Trout	3	-
2018	Goose Lake West Bay	Slimy Sculpin	27	74
	Goose Lake Southeast Basin		32	75
	Reference B Lake	Slimy Sculpin	8	82
		Lake Trout	4	-
2021	Propeller Lake – North Basin	Slimy Sculpin	147	65
	Propeller Lake – South Basin	Slimy Sculpin	55	55
	Goose Lake	Lake Trout	32	-
	Propeller Lake		29	-
Total			160	374

Note:

FC = fish community data (i.e., fish were generally non-lethally sampled, and data included the number of fish captured/observed per species, length, weight, age, and where possible, sex and maturity); FH = fish health data (i.e., fish were lethality sampled, and data generally included external condition, length, weight, age, sex, maturity, and internal health assessment including liver and gonad weights); "-" = not sampled.

Table KIA-NWB-02-5: Available Baseline Fish Tissue Chemistry Data

Year	Sampling Lake/Area	Species	Number of Fish Tissue Samples	
			Carcass	Muscle
2011	Goose Lake	Lake Trout	-	6
	Reference B Lake		-	7
2012	Goose Lake	Lake Trout	-	4
	Reference B Lake		-	12
2013	Goose Lake West Bay	Slimy Sculpin	8	-
	Goose Lake Southeast Basin		8	-
	Propeller Lake		8	-
	Reference B Lake		8	-
2018	Goose Lake West Bay	Slimy Sculpin	16	-
	Goose Lake Southeast Basin		16	-
	Reference B Lake		16	-
2021	Goose Lake	Slimy Sculpin	8	-
	Propeller Lake		8	-
Total			96	29

Note:

"-" = not sampled.

1.1.3 KIA-NWB-03

Review Comment Number	KIA-NWB-03
Subject/Topic	Terminology
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831, Sections 4.2.1, 4.2.3, 5.1.4, 5.2.4, 5.3.4, 5.4.5.7, 6.4
Detailed Review Comment	The term “normal range(s)” is used 46 times in the document. It is stated that the compiled baseline data are sufficient to support normal range calculations and that normal ranges will be used to evaluate project effects. However, the term is not defined. It is not a standard term in the field of statistics or of water-quality science.
Recommendation/ Request	Please include a precise definition of “normal range”.
Importance	Low
B2Gold Nunavut Response	The normal range is an estimate of the natural range of variability for a monitoring endpoint and is calculated based on the distribution of reference and/or baseline values (Barrett et al. 2015). Normal ranges can be used to quantify natural variability in biological endpoints and deviations from the normal range have been used in environmental monitoring programs as an early warning indicator to detect change from the reference condition.

1.1.4 KIA-NWB-04

Review Comment Number	KIA-NWB-04
Subject/Topic	Water quality sampling
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831, Section 4.2.4
Detailed Review Comment	On page 4-9 It is stated that: Previous versions of the AEMP included water quality monitoring at lake outlets in early spring (June; one to two weeks after freshet) and August. Stream sampling was removed from this version of the AEMP according to the following rationale: Water quality monitoring in lakes is sufficient to track changes in water quality due to the Project, and to characterize water quality entering downstream waterbodies. This implies that water quality in August is representative of the entire year. However, if the deep areas of the lakes stratify, the chemistry of the epilimnia may differ from that of the (fully mixed) water column in June (which would correspond to that of lake-outflow samples). Furthermore, runoff is much higher in June which could also influence water quality. Overall, it seems that information on the effects of stratification and runoff (i.e., of seasonality) on water quality is being lost by not sampling the outflows in June as well as the central lake stations in August.
Recommendation/ Request	Considering seasonality in runoff and water-column stratification, please discuss whether sampling only in August is in fact sufficient to characterize lake water quality. If not, continuation of the June sampling event is recommended.
Importance	High
B2Gold Nunavut Response	With the exception of the West Bay, most of Goose Lake is relatively shallow. The main basin of Goose Lake (where Central Basin sampling area is located) has water depths of between 4 and 14 m. Maximum depth at the Goose Lake Central Basin sampling area is 5 m. The area leading to the Goose Lake outlet (called Goose Lake Tail) has a maximum depth of 4 m. A thermocline or chemocline has not been observed in the Central Basin or Tail sampling areas during the open-water season, suggesting that the water columns in these areas are fully mixed. During the ice-cover season, water temperature within the water column ranged from 1°C to 4°C in these areas and no variation in specific conductivity with depth was observed in baseline studies. Thus, based on the baseline monitoring to date, stratification in these two sampling areas closest to the outlet is not expected. See CIRNAC-R-04 for a discussion of seasonality in the stream and lake water quality. Based on the baseline data, August is sufficient to characterize open-water quality in Goose Lake.

1.1.5 KIA-NWB-05

Review Comment Number	KIA-NWB-05
Subject/Topic	Use of parametric statistics
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831, Section 5.1.4
Detailed Review Comment	It is stated that *"If parameter concentrations naturally exceeded water quality guidelines under baseline conditions, then the AEMP benchmark will be based on the baseline mean plus two standard deviations."* This approach is problematic because water quality data is often skewed. For instance, for an example random sample (n=50) of data with Avg.=10 and SD=5, swapping a single datum with an extreme value of 100 results in an approximate doubling of the benchmark from ~20 to ~40 because of the greatly increased standard deviation (SD). The mean plus 2 SDs is approximately equal to the 95th percentile of the data; therefore, an upper percentile such as the 90th or 95th (depending on the quantity of baseline data) could be used as a benchmark that would not be appreciably influenced by a small number of extreme values (and no outlier removal would be needed). Furthermore, it is stated that *"Parameters with mean/median values that exceed the normal range will be identified as "parameters of interest" and further evaluated in the BACI statistical analysis." The mean and median values may differ appreciably if (as is probable) the data are not normally distributed; in this case, it is not clear whether the mean or median would be compared to the "normal range".*
Recommendation/ Request	The use of a non-parametric approach is recommended. Alternatively, provide justification for the proposed use of parametric statistics (means, standard deviations) in defining benchmarks and comparing data to normal ranges.
Importance	High
B2Gold Nunavut Response	After consideration of the comments received on the AEMP, we calculated the AEMP benchmarks and normal ranges and these are presented in Table ECCC-08-1 for AEMP benchmarks and Table ECCC-10-1 for normal ranges. A non-parametric approach was used as recommended. After considering site-specific water quality objectives and most recently derived federal environmental quality guidelines, there were no parameters that required the use of an upper bound of baseline concentration to set AEMP benchmarks. Parameters with median values that exceed the normal range will be identified as "parameters of interest". Normal ranges were calculated using the 90th percentile of the baseline dataset, consistent with the approach suggested by the reviewer. Normal ranges were calculated for ice-cover and open-water conditions, with the median values of annual monitoring results compared to the appropriate normal range. This approach will provide a

	measure of central tendency of the annual monitoring results without assuming a normal distribution of the data.

1.1.6 KIA-NWB-06

Review Comment Number	KIA-NWB-06
Subject/Topic	Statistical tests
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831, Section 4.2.3; Section 5.1.4; Section 5.3.4; Section 5.4.5
Detailed Review Comment	In the description of the statistical design there are references to "the BACI test" and in the data analysis section it is stated that "[a] BACI statistical analysis will be used to analyze the water quality data further to compare exposure and reference areas". However, BACI (before-after-control-impact) is a sampling design not a statistical test; no details are provided on how the significance of differences in water quality between exposure and reference will be determined. For the ordination of the benthic invertebrate data – why is logtransformation proposed for use of a non-parametric method (NMDS)? For testing differences in fish metrics, ANOVA is proposed but it is not clear to this reviewer what the groups in the test would be – reference vs. exposure is only 2 groups which would suggest that a t-test (or non-parametric alternative) should be used.
Recommendation/ Request	Please provide clarification on statistical methods: (1) state the test that will be used to assess the significance of differences in water quality between exposure and reference areas; (2) Provide a rationale for log-transforming the benthic data prior to use of NMDS, and (3) explain the groups that will be compared by ANOVA in analysis of fish metrics.
Importance	Moderate
B2Gold Nunavut Response	(1) For water quality parameters the *Before-After Control-Impact* (BACI) analysis will be completed using a two-factor ANOVA. Area and Year, as well as the interaction between these factors, will be included as terms in the analysis. A significant interaction term ($P < 0.1$) will be considered to be a significant BACI test result. (2) Log-transforming the invertebrate density data before calculating the distance measures (Bray-Curtis distance) used as the input to non-metric multidimensional scaling (NMDS) is often done to address several key issues. In ecological datasets, some taxa (genera or species) may be very abundant while others are rare. Log transformation reduces the influence of dominant taxa, allowing less common taxa to contribute more equally to the analysis. NMDS relies on distance or dissimilarity measures, and log transformation can improve the performance of these measures by stabilizing variance and making the data more comparable. (3) Fish health endpoints will be compared among sampling areas using ANOVA models. This approach will accommodate model covariates (i.e., ANCOVA), as well as comparisons among multiple groups. While a minimum of two sampling areas will be compared during the fish health program (i.e., exposure and reference), it is anticipated that additional sampling areas may be included in the future (e.g., Propeller Lake, see Table 4.2-2). When

	testing with two groups, a t-test and a one-way ANOVA are equivalent. Both statistical tests can be used to determine if there's a significant difference between the means of two groups and produce identical *P*-values. Therefore, there is no functional benefit in limiting statistical comparisons to t-tests.

1.2 ENVIRONMENT AND CLIMATE CHANGE CANADA

1.2.1 ECCC-01

Review Comment Number	ECCC-01
Subject/Topic	Site Contact Water Discharge
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 • Section 2.2: Discharges to the Receiving Environment • Section 3.2: Stressors of Concern and Transport Pathways
Detailed Review Comment	Section 2.2 lists discharges to the receiving environment, including "dewatering of open pit contact water to Goose Lake (likely via tundra discharge), with or without treatment." Section 3.2 provides more detail, stating, "Effluent from water management facilities, such as the emergency discharge pond (Sabina 2021) used to manage contact water, runoff or snowmelt (e.g. runoff or snowmelt to the Open Pits) may also be discharge to land if effluent quality criteria defined in the Type A Water Licence are met." No additional details are provided on the location of this discharge, the flow path, and the potential for this discharge to enter surface waters. This information is needed to clarify if any subsequent impacts to Goose Lake are adequately captured through Aquatic Effects Management Plan (AEMP) monitoring.
Recommendation/ Request	ECCC recommends that the Proponent include additional details on the location of site contact water discharge to land, on the expected flow path, and on the potential for discharge water to enter surface waters.
B2Gold Nunavut Response	In May 2024, B2Gold Nunavut provided an updated Water Management Plan to the NWB which incorporated the dewatering of open pit contact water to Goose Lake (likely via tundra discharge), with or without treatment. This update was intended to manage runoff and snow melt into the Open Pit, however B2Gold Nunavut is notifying ECCC that this discharge was not necessary to occur as water was managed in-situ. Further, B2Gold Nunavut is clarifying that the use of Echo Open Pit is now converted to a Tailings Storage Facility and the dewatering of open pit contact water to Goose Lake will not need to occur.

1.2.2 ECCC-02

Review Comment Number	**ECCC-02**
Subject/Topic	Mixing Zone
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 3.5: Summary of Water Quality Predictions
Detailed Review Comment	Section 3.5 states, "the modelling results indicate that concentrations of water quality parameters in Goose Lake are predicted to remain below applicable water quality guidelines and objectives at the edge of the mixing zone during closure, with the exception of phosphorus." No additional details are provided regarding the extent of the mixing zone, the location where benchmarks are expected to be met within Goose Lake, and how this relates to the proposed AEMP monitoring locations. Additional details are recommended to clarify the extent of the mixing zone.
Recommendation/ Request	ECCC recommends that the Proponent clarify the extent of the mixing zone by including the distance from discharge and the locations that are being considered for benchmarking within Goose Lake. This information should be related to the proposed AEMP monitoring stations.
B2Gold Nunavut Response	The rationale for the exposure sampling areas within Goose Lake is provided in Section 4.2.2 and Table 4.2-1 of the AEMP. The quoted text in the detailed review comment refers to the water quality modelling results for the Closure period, which is expected to occur after 15 years of operations. Details of the extent of the mixing zones in Goose Lake during the Closure period were provided in the most recent hydrodynamic and water quality model of Goose Lake (Golder 2022). As stated in Section 3.5, there will be time during operations to improve the understanding of the systems and the chemistry of the water to be discharged prior to the overflow from pits during the Closure period, and updates to modelling will be provided through the NWB process in advance of the Closure period.

1.2.3 ECCC-03

Review Comment Number	**ECCC-03**
Subject/Topic	Propeller Lake Sampling
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 3.5: Summary of Water Quality Predictions
Detailed Review Comment	Two separate monitoring areas are identified for Propeller Lake (South Basin and North Basin) and the Proponent states that, "Given the relatively large size of Propeller Lake, it is possible that the north basin can be used as a within-lake reference area for the south basin." In Table 4.2-1 the North Basin is included as an exposure area but then is also listed as a "within lake reference" in the "type of area" column. The table and the associated text indicating that the North Basin would "possibly" be used as a within lake reference creates confusion. Monitoring stations should be clearly identified as either reference or exposure and remain consistent throughout the sampling program. Caution should be applied when assessing potential in-lake reference areas since the North Basin of Propeller Lake is still downstream of the discharge and therefore has the potential to be impacted by mining activities. ECCC notes that the 2017 version of the AEMP had the Propeller Lake North Basin explicitly listed as a far-field exposure station.
Recommendation/ Request	ECCC recommends that North Basin of Propeller Lake is retained as a far-field exposure station, and that the AEMP is updated accordingly.
B2Gold Nunavut Response	As noted in the AEMP, Propeller Lake is much larger than Goose Lake; it remains possible that there will be no measurable changes in water quality in Propeller Lake North Basin, regardless of whether there are measurable changes in water quality in Goose Lake. Water quality monitoring under the AEMP will evaluate whether Propeller Lake North Basin may be used as a within-lake reference area for the south basin. The description in Table 4.2-1 for Propeller Lake North Basin will be changed to "Far-field and possible within lake reference" for clarity.

1.2.4 ECCC-04

Review Comment Number	**ECCC-04**
Subject/Topic	Sampling Frequency and Design
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 4.2.4: Sampling Design and Frequency
Detailed Review Comment	Section 4.2.4 includes several descriptions of the proposed surface water quality monitoring. However, contradicting descriptions of details pertaining to timing and sampling exceptions are provided, resulting in a lack of clarity on the monitoring plan. The previous version of the AEMP included tables (2017 version – Tables 4.3-3 & 4.3-4) that clearly outlined the monitoring program frequency. The updated version of the AEMP removed the tables in favor of a written description that is not clear and consistent.
Recommendation/ Request	ECCC recommends that the Proponent provide a table that clearly outlines the proposed surface water quality monitoring frequency.
B2Gold Nunavut Response	As requested, Tables ECCC-04-1 and ECCC-04-2 are provided in response to this request. As noted in Section 4.2.4, not all sampling areas or monitoring components will be sampled every year. The sampling area, sampling season, sampling year, and monitoring component depends on the Mine phase and timing of operational discharge. Section 4.2.4 also explains what areas and monitoring components are monitored and when. Text in Section 4.2.4 can be revised to improve clarity in response to the reviewer's comment. For the reviewer's information, a tentative schedule is provided in Table ECCC-04-3, based on dewatering of Llama and Umwelt lakes in 2025, biological monitoring in the following year, and initiation of monitoring in Goose Lake Southeast Basin and Propeller Lake three years prior to the initiation of pit overflow during the Closure period.

Table ECCC-04-1: Overview of the Aquatic Effects Management Plan Sampling Design by Component and Season

Waterbody	Sampling Area	Sampling Location ID	Sampling Season						
			Water Quality [a]		Sediment Quality	Benthic Invertebrate Community	Fish Health		Fish Tissue
			Full Chemistry [b,c]	Chlorophyll *a*			Slimy Sculpin (Lethal Survey	Lake Trout (Non-lethal Survey)	
Goose Lake	West Bay-inflow	BRP-29A	April, August	August	August	August	August	July	July, August
	West Bay-Echo	BRP-31	April, August	August	August	August	August		
	Central Basin	BRP-32	April, August	August	August	August	August		
	Southeast Basin	BRP-33	April, August	August	August	August	August		
Propeller Lake	South Basin	BRP-35	April, August	August	August	August	August	July	July, August
	North Basin	BRP-36	April, August	August	August	August	August		
Reference B Lake	Mid-lake	BRP-38	April, August	August	August	August	August	July	July, August

Notes:

Not all sampling areas or monitoring components will be sampled every year. See text (in Section 4.2.4 of the AEMP) for details.

[a] In years with effluent discharge to Goose Lake, water quality sampling in the near-field and reference areas will occur four times in the year: April, July, August, and September.

[b] April sampling may be omitted during phases of the Project when there is no under-ice discharge, or when there is no effluent discharge during the previous open-water season.

[c] Water quality sampling will also occur in July in years when the Lake Trout survey is completed.

Table ECCC-04-2: Aquatic Effects Management Plan Monitoring Program Frequency

Waterbody	Sampling Area	Sampling Location ID	Sampling Season						
			Water Quality		Sediment Quality	Benthic Invertebrate Community	Fish Health		Fish Tissue [a]
			Full Chemistry	Chlorophyll *a*			Slimy Sculpin (Lethal Survey)	Lake Trout (Non-lethal Survey)	
Goose Lake	West Bay-inflow	BRP-29A	Annual	Annual	Every three years	Every three years	Every three years	Every three years	Every six years
	West Bay-Echo	BRP-31	Annual	Annual	Every three years	Every three years	Every three years		
	Central Basin	BRP-32	Annual	Annual	Every three years	Every three years	Every three years		
	Southeast Basin [b]	BRP-33	Annual	Annual	Every three years	Every three years	Every three years		
Propeller Lake [b]	South Basin	BRP-35	Annual	Annual	Every three years	Every three years	Every three years	Every three years	Every six years
	North Basin	BRP-36	Annual	Annual	Every three years	Every three years	Every three years		
Reference B Lake	Mid-lake	BRP-38	Annual	Annual	Every three years	Every three years	Every three years	Every three years	Every six years

Notes :

Not all sampling areas or monitoring components will be sampled every year. See text (in Section 4.2.4 of the AEMP) for details. The schedule considers which near-field areas are most likely to be directly affected by each type of discharge, based on timing of discharge.

[a] Frequency of fish tissue chemistry monitoring may increase to every three years if triggered under the MDMER, or if a fish-tissue related effect is observed.

[b] Monitoring in Goose Lake Southeast Basin and Propeller Lake will occur at least three years prior to the initiation of pit overflow, and may be occur earlier pending the results of previous years' monitoring.

Table ECCC-04-3: Tentative Aquatic Effects Management Plan Monitoring Program Schedule

Phase/Year		Discharge occurring?	AEMP Components	Sampling Area
Construction	-1 (2025)	Yes (dewatering)	WQ	GLWB [a], GLCB, REFB
Operations	1 (2026)	No	WQ, BIC/SQ, Fish	GLWB, GLCB, REFB
Operations	2 (2027)	No	WQ	GLWB, GLCB, REFB
Operations	3 (2028)	No	WQ	GLWB [b], GLCB, REFB
Operations	4 (2029)	No	WQ [c]	GLCB, REFB
Operations	5 (2030)	No	WQ	GLCB, REFB
Operations	6 (2031)	No	WQ	GLCB, REFB
Operations	7 (2032)	No	WQ	GLCB, REFB
Operations	8 (2033)	No	WQ	GLCB, REFB
Operations	9 (2034)	No	WQ	GLCB, REFB
Operations	10 (2035)	No	WQ	GLCB, REFB
Operations	11 (2036)	No	WQ	GLCB, REFB
Operations	12 (2037)	No	WQ	GLCB, REFB
Operations	13 (2038)	No	WQ, BIC/SQ, Fish	GLCB, GLSE [d], PL [d], REFB
Operations	14 (2039)	No	WQ	GLCB, GLSE, PL, REFB
Operations	15 (2040)	No	WQ	GLWB [e], GLCB, GLSE, PL, REFB
Closure	16 (2041)	Yes (pit overflow)	WQ, BIC/SQ, Fish	GLWB[4], GLCB, GLSE, PL, REFB
Closure	17 (2042)	Yes (pit overflow)	WQ	GLWB, GLCB, GLSE, PL, REFB
Closure	18 (2043)	Yes (pit overflow)	WQ	GLWB, GLCB, GLSE, PL, REFB – tentative [f]
Closure	19 (2044)	Yes (pit overflow)	WQ, BIC/SQ, Fish	GLWB, GLCB, GLSE, PL, REFB – tentative [f]
Closure	20 (2045)	Yes (pit overflow)	WQ	GLWB, GLCB, GLSE, PL, REFB
Closure	21 (2046)	Yes (pit overflow)	WQ	GLWB, GLCB, GLSE, PL, REFB – tentative [f]
Closure	22 (2047)	Yes (pit overflow)	WQ, BIC/SQ, Fish	GLWB, GLCB, GLSE, PL, REFB – tentative [f]
Post-Closure	23 (2048)	Yes (pit overflow)	WQ	GLWB, GLCB, GLSE, PL, REFB
Post-Closure	24 (2049)	Yes (pit overflow)	WQ	GLWB, GLCB, GLSE, PL, REFB – tentative [f]
Post-Closure	25 (2050)	Yes (pit overflow)	WQ, BIC/SQ, Fish	GLWB, GLCB, GLSE, PL, REFB – tentative [f]
Post-Closure	26 (2052)	Yes (pit overflow)	WQ	GLWB, GLCB, GLSE, PL, REFB
Post-Closure	27 (2053)	Yes (pit overflow)	WQ	GLWB, GLCB, GLSE, PL, REFB – tentative [f]

Notes: Table presents a possible schedule based on dewatering of Llama and Umwelt lakes in 2025 and no discharge occurring until pit overflow in closure. This schedule may need to be adjusted pending the results of the previous year's monitoring and any updates to the Mine plan.

[a] Because dewatering discharge will enter Goose Lake at the West Bay-Inflow sampling area, this will be the near-field exposure area monitored.

[b] Depending on the water quality monitoring results, West Bay-Inflow may not need to be monitored in more than two or three years after dewatering discharge.

[c] If there is no discharge within the last three years, then biological monitoring may not be needed (consistent with current MDMER EEM requirements).

[d] B2Gold committed to collecting supplemental information in Propeller Lake at least three years prior to the initiation of pit overflow to augment the existing baseline dataset; therefore, monitoring in this lake will be initiated in Year 13 for all components (i.e., water quality, sediment quality, benthic invertebrate community, and fish health and tissue chemistry). Monitoring will also start in Goose Lake Southeast Basin.

[e] Water quality monitoring will be conducted in all Goose Lake sampling areas prior to the expected start of pit overflow discharge in Year 16. If deemed necessary, this monitoring may be initiated sooner than Year 15.

[f] The sampling areas to be monitored in these years are tentative, pending the results of previous year's monitoring (i.e., fewer sampling areas may be monitored).

WQ = water quality; GLWB = Goose Lake West Bay; GLCB = Goose Lake Central Basin; GLSE = Goose Lake Southeast Basin; PL = Propeller Lake; REFB = Reference B Lake; BIC = benthic invertebrate community survey; SQ = sediment quality.

1.2.5 ECCC-05

Review Comment Number	**ECCC-05**
Subject/Topic	Changes to Monitoring Frequency and Design
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 4.2.4: Sampling Design and Frequency
Detailed Review Comment	The updated version of the AEMP includes reductions in monitoring as compared to the 2017 version but does not provide a rationale for the changes. The 2017 version indicated that all surface water quality monitoring stations were to be sampled annually, while the current version proposes reductions in frequency and changes to sampling based on the previous years monitoring. ECCC notes that AEMP's should not change on an annual basis as they are intended to provide consistent data collection to allow for clear interpretation of results and to assess potential impacts to aquatic life. Inconsistent monitoring may lead to gaps in the dataset that result in a reduced ability to interpret results and assess potential effects. The AEMP should clearly outline what is to be monitored by including the sampling frequency and timing for all stations. Any reductions in sampling should be based on monitoring results and be supported by a clear rationale rather than be assumed in the monitoring program.
Recommendation/ Request	ECCC recommends that the Proponent clearly outline all changes to monitoring frequency and design as compared to the 2017 AEMP. All changes to the monitoring program should be accompanied by supporting rationale.
B2Gold Nunavut Response	A summary of changes to the monitoring frequency and design in the updated AEMP compared to the October 2017 version is provided in Appendix A, Table A-4. The monitoring frequency in the updated AEMP was revised to improve sampling efficiency and focus monitoring on exposure areas that are most likely to be influenced by Project activities. The updated AEMP provides more clarity than the October 2017 version as to what and when sampling areas are sampled, based on the expected influence of the Project on the receiving environment. For example, during dewatering, the West Bay-inflow sampling area will be the near-field exposure area, as this is the area closest to the entry of dewatering discharge into Goose Lake (and thus the most relevant exposure area according to MDMER EEM guidance). It is not necessary to monitor water quality in all four sampling areas in Goose Lake (West Bay-inflow, West Bay-Echo, Central Basin, Southeast Basin) and two sampling areas in Propeller Lake (South Basin and North Basin) every year during dewatering. Spatial and temporal extent of effects of dewatering discharge on Goose Lake water quality is expected to be limited. In fact, given that the dewatering discharge is off natural lake water, no measurable changes in Goose Lake water quality are expected. The updated AEMP includes annual water quality monitoring at Goose Lake Central Basin and

	Reference B Lake regardless of Project phase, and it is expected that these sampling areas will provide continuity in monitoring results that the reviewer is concerned about. Note that both the October 2017 version and the updated versions of the AEMP state that the AEMP is a living document and it will be updated, as necessary, based on regulatory changes, Project-related changes, incident investigations, the need for changes to existing mitigation measures, and input from regulators and the KIA.

1.2.6 ECCC-06

Review Comment Number	**ECCC-06**
Subject/Topic	Discontinuation of Stream Sampling
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 4.2.4: Sampling Design and Frequency
Detailed Review Comment	The presented version of the AEMP proposed the discontinuation of stream water quality sampling. In the 2017 version, stream monitoring was to be completed twice per year, with the first annual samples to be collected one to two weeks after freshet (mid-late June) and the second to be collected in August. The rationale provided for removing this monitoring is that water quality monitoring in lakes is sufficient to characterize changes and that these locations were initially chosen for consistency with modelling locations and to be used as compliance points. However, this rationale does not address the implications of removing the June freshet sampling. Removal of the June stream sampling may result in water quality data gaps during spring freshet, when increased runoff is expected.
Recommendation/ Request	ECCC recommends the Proponent expand their rationale for removing stream monitoring to specifically address the June freshet sampling period. The rationale should acknowledge potential information gaps that may be introduced by not sampling the stream during freshet.
B2Gold Nunavut Response	Removing the stream outlets from the monitoring will not result in information gaps. Effects on Goose Lake water quality as a result of runoff from the Mine site will be captured in the lake monitoring. See responses to KIA-NWB-04 and CIRNAC-R-04.

1.2.7 ECCC-07

Review Comment Number	**ECCC-07**
Subject/Topic	Fish Health Monitoring Frequency
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 4.2.4: Sampling Design and Frequency
Detailed Review Comment	Section 4.2.4 states that fish tissue chemistry will be completed every six years. ECCC notes that this represents a change in monitoring frequency from the 2017 AEMP, which proposed fish health and fish tissue monitoring on a three-year timeline. No rationale has been provided for this change.
Recommendation/ Request	ECCC recommends that the Proponent provide supporting rationale for the proposed change in monitoring frequency for fish health and fish tissue.
B2Gold Nunavut Response	The change in fish tissue sampling frequency was adopted following a request from Environment and Climate Change Canada (WT-ECCC-TC-9) during the regulatory review of the Water Licence application. B2Gold committed to reducing the fish tissue sampling frequency of Slimy Sculpin to once every six years unless fish tissue sampling was triggered for mercury and selenium under the MDMER. Table A-2 showing concordance of the AEMP with the revisions requested by ECCC is provided in Appendix A.

1.2.8 ECCC-08

Review Comment Number	**ECCC-08**
Subject/Topic	Water Quality Benchmarks
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 5.1.4: Data Analysis and Interpretation
Detailed Review Comment	The plan states that water quality data will be compared to AEMP benchmarks, and that these will be based on the current applicable federal aquatic life guidelines for the protection of aquatic life, drinking water quality guidelines, and approved site-specific water quality objectives for the Project. However, a table outlining which guidelines will be used for which parameters has not been included in the AEMP. In some cases, multiple guidelines exist for a single parameter but the AEMP does not provide a description on how guidelines will be selected in these cases. ECCC specifically notes that in cases where both Federal Environmental Quality Guidelines (FEQG) and CCME guidelines exist, the FEQG should be used, as these reflect the most recent science in their development. In addition, some guidelines incorporate information on toxicity modifying factors to calculate a value with increased site-specificity. Inclusion of a table outlining the values and sources for all AEMP benchmarks would increase clarity on what the water quality data is being evaluated against.
Recommendation/ Request	ECCC recommends that: • The Proponent provide a table summarizing the AEMP benchmarks selected for the site. This should incorporate recently updated guidelines, including the FEQGs, as well as clearly outline the relevant toxicity modifying factors. • In cases where multiple guidelines exist, rationale should be provided on how the guideline was selected.
B2Gold Nunavut Response	The selection of AEMP benchmarks was based on site-specific water quality objectives (SSWQOs) and, for parameters without SSWQOs, current applicable federal water quality guidelines for the protection of aquatic life. The most current of the Canadian Council of Ministers of the Environment (CCME) Canadian water quality guidelines or the federal environmental quality guidelines were used. If a federal guideline was not available, then water quality guidelines from other jurisdictions were considered. Table ECCC-08-02 presents the selected AEMP benchmarks.

Table ECCC-08-2: AEMP Benchmarks

Parameter	Unit	Site-specific Water Quality Objective	Canadian Water Quality Guideline for the Protection of Aquatic Life (CCME 1999)	Federal Environmental Quality Guideline (GOC 2024)	Water Quality Guideline for Protection of Aquatic Life - Other Jurisdictions as Indicated	AEMP Benchmark [a]
Conventional Parameters						
pH	-	-	**6.5 - 9.0**	-	-	6.5 - 9.0
Total dissolved solids	mg/L	-	-	-	**500** [b]	500
Total suspended solids	mg/L	-	**5 + background**	-	-	8 [c]
Ions and Other						
Chloride	mg/L	-	**120**	-	-	120
Fluoride	mg/L	-	**0.12**	-	-	0.12
Sulphate	mg/L	-	-	-	**Hardness-dependent** [d]	Hardness-dependent [d]
Total cyanide	mg/L	-	**0.0050**	-	-	0.0050
Nutrients						
Nitrate	mg-N/L	-	**2.93**	-	-	2.93
Nitrite	mg-N/L	-	**0.060**	-	-	0.060
Total ammonia	mg-N/L	-	**pH and temperature dependent** [e]	-	-	pH and temperature dependent [e]
Total phosphorus	mg-P/L	-	**0.01** [f]	-	-	0.01
Total Metals						
Aluminum	µg/L	-	5.0 - 100 [g]	**pH, DOC, and hardness dependent** [h]		pH, DOC, and hardness dependent [h]
Antimony	µg/L	-	-	-	**74** [g]	74
Arsenic	µg/L	**10** [j]	5.0	-	-	10
Barium	µg/L	-	-	-	**1,000** [g]	1,000
Beryllium	µg/L	-	-	-	**0.13** [g]	0.13
Boron	µg/L	-	**1,500**	-	-	1,500
Cadmium	µg/L	-	**Hardness dependent** [k]	-	-	Hardness dependent [k]
Chromium	µg/L	-	1.0	**5.0**	-	5.0
Cobalt	µg/L	-	-	**Hardness dependent** [l]	-	Hardness dependent [l]
Copper	µg/L	**4.2** [m]	-	-	-	4.2
Iron	µg/L	-	300	**pH and DOC dependent** [n]	-	pH and DOC dependent [n]
Lead	µg/L	-	1 [o]	**DOC and hardness dependent** [p]	-	DOC and hardness dependent [p]
Mercury	µg/L	-	**0.026**	-	-	0.026
Molybdenum	µg/L	-	**73**	-	-	73
Nickel	µg/L	-	**Hardness dependent** [q]	-	0.8 [r]	Hardness dependent [q]
Selenium	µg/L	-	**1.0**	-	-	1.0
Silver	µg/L	-	**0.25**	-	-	0.25
Strontium	µg/L	-	-	**2,500**	-	2,500
Thallium	µg/L	-	**0.80**	-	-	0.80
Uranium	µg/L	-	**15**	-	-	15
Vanadium	µg/L	-	-	**120**	-	120
Dissolved Metals				-		
Manganese	µg/L	-	**pH and hardness dependent** [s]	-	-	pH and hardness dependent [s]
Zinc	µg/L	-	**pH, DOC, and hardness dependent** [t]	-	-	pH, DOC, and hardness dependent [t]
Radionuclides						
Radium-226	Bq/L	-	-	-	**0.11** [u]	0.11

Notes: Objectives/guidelines selected for the AEMP benchmark are bolded.

[a] Median measured values of exposure and toxicity modifying factors (i.e., pH, hardness, dissolved organic carbon [DOC], temperature) will be used to calculate AEMP benchmarks, as appropriate.

[b] Source: Alaska Department of Environmental Conservation (2012) Water Quality Standards.

[c] The 90th percentile of baseline total suspended solids concentration is <3 mg/L, which was used to calculate the AEMP benchmark.

[d] Hardness dependent guideline: 128 mg/L at hardness ≤30 mg/L as $CaCO_3$; 18 mg/L at hardness 31 to 75 mg/L as $CaCO_3$; 309 mg/L at hardness 76 to 180 mg/L as $CaCO_3$; 429 mg/L at hardness ≥181 mg/L as $CaCO_3$. Source: BC ENV (2025) British Columbia Approved Water Quality Guidelines.

[e] pH and temperature dependent guideline is calculated using the equation: $0.019/(1/(10^{(0.0901821+2729.92/(Temperature+273.15)-pH)+1)})*0.8224$.

[f] This value is the upper limit of the oligotrophic range (CCME 2004) to maintain the current trophic status of Goose Lake; used as a surface water quality benchmark in the hydrodynamic and water quality model of Goose Lake (Golder 2022).

[g] pH dependent guideline.

[h] pH, DOC, and hardness dependent guideline is calculated using the equation: $e^{((0.645 \times \ln(DOC))+(2.255 \times \ln(hardness))+(1.995 \times pH)+(-0.284 \times (\ln(hardness) \times pH))-9.898)}$ and is valid within the ranges of pH 6 to 8.7, DOC 0.08 to 12.3 mg/L, and hardness 10 to 430 mg/L as $CaCO_3$. If measured median values are outside these ranges, then the lower or upper limit of the range will be used instead.

[i] Source: BC ENV (2025).

[m] Source: Golder (2017).

[k] Hardness dependent guideline: 0.04 µg/L at hardness >0 to <17 mg/L as $CaCO_3$; calculated using the equation $10^{(0.83(\log[hardness])-2.46)}$ at hardness ≥17 to ≤280 mg/L as $CaCO_3$; 0.37 µg/L at hardness >280 mg/L as $CaCO_3$.

[l] Hardness dependent guideline is calculated using the equation: $e^{((0.414[\ln(hardness)]-1.887)}$ and is valid within the calibration range of hardness of 52 to 396 mg/L as $CaCO_3$. If measured median values are outside these ranges, then the lower or upper limit of the range will be used instead.

[m] Source: Sabina (2015) Final Environmental Impact Statement, Volume 6: Freshwater Environment, Chapter 4: Freshwater Quality.

[n] pH and DOC dependent guideline; calculated using Environment and Climate Change Canada total iron federal environmental quality guideline calculator (ECCC 2024). The guideline is valid within the ranges of pH 6 to 8.5 and DOC 0.3 to 10.9 mg/L. If measured median values are outside these ranges, then the lower or upper limit of the range will be used instead.

[o] Hardness dependent guideline.

[p] DOC and hardness dependent guideline is calculated using the equation: $e^{(0.514[\ln(DOC)]+0.214[\ln(Hardness)]+0.4152)}$ and is valid within the ranges of DOC 0.5 to 31.5 mg/L and hardness 4.7 to 511 mg/L as $CaCO_3$. If measured median values are outside these ranges, then the lower or upper limit of the range will be used instead.

[q] Hardness dependent guideline: 25 µg/L at hardness 0 to ≤60 mg/L as $CaCO_3$; calculated using the equation $e^{(0.76[\ln(hardness)]+1.06)}$ at hardness >60 to ≤180 mg/L as $CaCO_3$; 150 µg/L at hardness >180 mg/L as $CaCO_3$.

[r] BC recently published a new nickel water quality guideline that uses a biotic ligand model. Using the look-up table (temperature 15°C, pH 6.5, DOC 4 mg/L, 20 mg/L hardness), the resulting guideline value was an order of magnitude lower than the normal range and thus not deemed suitable as an AEMP benchmark.

[s] pH and hardness dependent guideline; calculated using Canadian Council of Ministers of the Environment dissolved manganese calculator (CCME 2019). The guideline is valid within the calibration ranges of pH 5.8 to 8.4 and hardness 25 and 670 mg/L as $CaCO_3$. If measured median values are outside these ranges, then the lower or upper limit of the calibration will be used instead.

[t] pH, DOC, and hardness dependent guideline is calculated using the equation: $e^{((0.947 \times \ln(hardness))-(0.815 \times pH)+(0.398 \times \ln(DOC))+4.625)}$ and is valid within the ranges of pH 6.5 to 8.13, DOC 23.4 to 399 mg/L, and hardness 0.3 to 22.9 mg/L as $CaCO_3$. If measured median values are outside these ranges, then the lower or upper limit of the range will be used instead.

[u] Source: SK ENV (2025).

1.2.9 ECCC-09

Review Comment Number	**ECCC-09**
Subject/Topic	Baseline Exceedances of Water Quality Guidelines
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 5.1.4: Data Analysis and Interpretation
Detailed Review Comment	The plan states, "if parameter concentrations naturally exceeded water quality guidelines under baseline conditions, then the AEMP benchmark will be based on the baseline mean plus two standard deviations." The plan does not identify which parameters were identified that naturally exceed water quality guidelines or provide rationale for the proposed benchmark of baseline mean plus two standard deviations. In addition, the resulting numerical values for these parameters have not been provided. ECCC notes that the approach of baseline mean plus two standard deviations may not be appropriate depending on the baseline dataset and it is possible that resulting values may not be protective of aquatic life.
Recommendation/ Request	ECCC recommends the Proponent: • Clearly identify which parameters naturally exceed water quality guidelines under baseline conditions. • Provide justification for the proposed approach of baseline mean plus two standard deviations. • Provide a summary of the resulting numeric values for each parameter.
B2Gold Nunavut Response	The baseline mean plus two standard deviations has been used to set AEMP benchmarks for other northern mines (e.g., Gahcho Kué Mine). It represents the upper bound of baseline conditions. After considering site-specific water quality objectives and most recently derived federal environmental quality guidelines, there were no parameters that required the use of an upper bound of baseline concentrations to set its AEMP benchmarks. See Table ECCC-08-1 for AEMP benchmarks.

1.2.10 ECCC-10

Review Comment Number	**ECCC-10**
Subject/Topic	Establishment of Normal Range Concentrations
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 5.1.4: Data Analysis and Interpretation
Detailed Review Comment	The analysis and interpretation of lake water quality data proposes that water quality data from the lake exposures will be evaluated by comparison to AEMP benchmarks, and normal ranges. In discussion of the normal ranges, it is stated that baseline data from 2010 to 2018 has been pooled for Goose Lake, that additional data was collected in 2021, 2022, and 2024 to address uncertainty, and that, if appropriate, normal ranges may be updated with future AEMP reference data as they become available to further characterize natural variability. However, the normal ranges for each parameter have not been provided. Compilation of normal ranges is also discussed in relation to other aspects of AEMP monitoring (e.g. sediment quality, benthos) but the resulting values have also not been presented. It is unclear based on the information provided whether the establishment of the normal ranges based on the baseline data collection has been completed. If baseline normal range values are established, they should be presented with the AEMP study design or their location within another plan explicitly referenced.
Recommendation/ Request	ECCC recommends that the baseline water quality data normal ranges are summarized in the AEMP.
B2Gold Nunavut Response	Normal ranges were developed for Goose Lake water quality parameters during both under-ice and open-water conditions. A non-parametric approach was adopted for normal range calculations, consistent with the approach suggested by the Kitikmeot Inuit Association (KIA-NWB-05). Normal ranges were calculated for each parameter and season (i.e., under-ice and open-water) as the 90th percentile of the baseline datasets. Consistent with the nutrient enrichment and toxicological impairment hypotheses, upper bounds of the normal range were calculated for water quality parameters. Lower bounds were not calculated, as a decrease in the concentration of these parameters would not present a risk to the aquatic environment. If the 90th percentile was less than two times the detection limit, the upper bound of the normal range was set at two times the detection limit. Normal ranges for water quality parameters are provided in Table ECCC-10-1.

Table ECCC-10-1: Upper Bounds of the Normal Range for Water Quality Parameters

Parameter	Units	Under-ice	Open-water
Total dissolved solids (calculated per APHA 2005)	mg/L	48	28
Total suspended solids	mg/L	6	6
Bicarbonate, as $CaCO_3$	mg/L	11	10
Calcium	mg/L	7.2	4.4
Chloride	mg/L	10.1	5.8
Cyanide	mg/L	0.010	0.010
Fluoride	mg/L	0.04	0.04
Magnesium	mg/L	3.95	2.63
Potassium	mg/L	0.956	0.501
Sodium	mg/L	6.01	0.97
Sulphate	mg/L	16	9.4
Reactive Silica	mg/L	3.0	1.0
Nitrate	mg-N/L	0.185	0.119
Nitrite	mg-N/L	0.002	0.002
Total ammonia	mg-N/L	0.035	0.020
Total nitrogen	mg-N/L	0.423	0.424
Total phosphorus	mg-P/L	0.005	0.007
Chlorophyll *a*	µg/L	0.92	0.67
Total Aluminum	µg/L	30	21
Total Antimony	µg/L	0.049	0.042
Total Arsenic	µg/L	0.358	0.273
Total Barium	µg/L	16.0	8.2
Total Beryllium	µg/L	0.007	0.004
Total Boron	µg/L	10	10
Total Cadmium	µg/L	0.022	0.0095
Total Chromium	µg/L	0.26	0.15
Total Cobalt	µg/L	0.603	0.412
Total Copper	µg/L	3.3	1.7
Total Iron	µg/L	40	56
Total Lead	µg/L	0.19	0.091
Total Manganese	µg/L	11	5.5
Total Mercury	µg/L	0.0041	0.0011
Total Molybdenum	µg/L	0.02	0.02
Total Nickel	µg/L	10.0	4.09
Total Selenium	µg/L	0.050	0.050
Total Silver	µg/L	0.004	0.004

Total Strontium	µg/L	39.7	25.9
Total Thallium	µg/L	0.003	0.002
Total Tin	µg/L	0.12	0.02
Total Titanium	µg/L	0.12	0.18
Total Uranium	µg/L	0.016	0.006
Total Vanadium	µg/L	0.08	0.06
Total Zinc	µg/L	4.1	2.1
Dissolved Aluminum	µg/L	29.0	13.3
Dissolved Antimony	µg/L	0.038	0.075
Dissolved Arsenic	µg/L	0.49	0.26
Dissolved Barium	µg/L	14.00	8.64
Dissolved Beryllium	µg/L	0.007	0.004
Dissolved Boron	µg/L	10	10
Dissolved Cadmium	µg/L	0.019	0.011
Dissolved Chromium	µg/L	0.20	0.10
Dissolved Cobalt	µg/L	0.628	0.341
Dissolved Copper	µg/L	3.30	1.54
Dissolved Iron	µg/L	22.7	21.3
Dissolved Lead	µg/L	0.053	0.024
Dissolved Manganese	µg/L	8.90	4.79
Dissolved Mercury	µg/L	0.0024	0.0010
Dissolved Molybdenum	µg/L	0.020	0.25
Dissolved Nickel	µg/L	11.0	4.05
Dissolved Selenium	µg/L	0.050	0.050
Dissolved Silver	µg/L	0.004	0.004
Dissolved Strontium	µg/L	40	25
Dissolved Thallium	µg/L	0.002	0.002
Dissolved Tin	µg/L	0.12	0.07
Dissolved Titanium	µg/L	0.10	0.10
Dissolved Uranium	µg/L	0.016	0.006
Dissolved Vanadium	µg/L	0.05	0.06
Dissolved Zinc	µg/L	4.1	1.9
Radium-226	Bq/L	n/a	0.045

1.2.11 ECCC-11

Review Comment Number	**ECCC-11**
Subject/Topic	Identification of Parameters of Interest
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Section 5.1.4: Data Analysis and Interpretation
Detailed Review Comment	Section 5.1.4 described identification of parameters of interest and states that, "parameters with mean/median values that exceed the normal range will be identified as "parameters of interest" and further evaluated in the Before After Control Impact (BACI) analysis. Parameters with mean/median concentrations below the upper limit of their normal range will not be evaluated further". ECCC notes that depending on the dataset, the mean and median values may differ. It should be made clear whether the mean or median is intended to be used for comparison to normal range.
Recommendation/ Request	ECCC recommends the Proponent clarify whether the mean or median is intended to be used for comparison to the normal range.
B2Gold Nunavut Response	After consideration of the comments received on the AEMP, we decided that a non-parametric approach would be used to calculate normal ranges and thus median values will be compared to normal ranges, with separate comparisons for the ice-cover and open-water seasons. This approach will provide a measure of central tendency of the annual monitoring results without assuming a normal distribution of the data.

1.2.12 ECCC-12

Review Comment Number	**ECCC-12**
Subject/Topic	Proposed Low Action Levels
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831 Table 6.3-1: Proposed Low Action Levels for the Toxicological Impairment and Nutrient Enrichment Hypothesis
Detailed Review Comment	Table 6.3-1 provides proposed low action levels for components of the AEMP. For water quality, the action level includes, "statistically significant BACI effect on concentration in the exposure area, with the average concentration above the normal range" and "average concentration above the AEMP benchmark." As worded, the low action level requires the average concentration to exceed the AEMP benchmark prior to any action being taken. ECCC notes that a low action level exceeding a benchmark is not sufficiently conservative and is not consistent with action level frameworks at other mining operations in the Northwest Territories and Nunavut. Low action levels for water quality are typically set as a percentage of the AEMP benchmark (e.g. 70%) to trigger action in advance of a benchmark exceedance to ultimately avoid exceedances of AEMP benchmarks. ECCC notes that the previous version of the AEMP stated the intention to establish action levels based on a percentage of the AEMP benchmark, but this has not been carried through to this version. In addition, the use of "average" has not been further defined, so it is unclear what this term refers to for purposes of analysis against action levels. For example, this could be a lake-wide average, monthly average, or seasonal average. If the calculated average concentration exceeds the benchmark this implies that there would have been numerous individual exceedances of the benchmark, suggesting potential risk to aquatic life.
Recommendation/ Request	ECCC recommends: • The Proponent establish low action levels to trigger action in advance of exceeding AEMP benchmarks. • If an average value is used in the action level, the dataset used to calculate the average should be defined.
B2Gold Nunavut Response	Exceedance of an AEMP benchmark does not indicate adverse effects to the receiving environment are likely, just that further evaluation is required to assess the potential for effects. However to impart additional conservatism to the early warning trigger, the low action level for water quality can be revised to trigger at a percentage of the AEMP benchmark as suggested by the reviewer. The median value will be compared to the normal range and to the AEMP benchmark. The low action level for water quality will be revised to be:

	Statistically significant BACI effect on concentration in the exposure area, with the median concentration above the normal range AND Median concentration above 80% of the AEMP Benchmark.

1.3 CROWN-INDIGENOUS RELATIONS AND NORTHERN AFFAIRS CANADA

1.3.1 CIRNAC-R-01

Review Comment Number	**CIRNAC-R-01**
Subject/Topic	Untracked Revisions and Commitments
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831
Comment	Type A Water Licence No. 2AM-BRP1831, Part B, Item 16 states: "The Licensee shall review the Plans referred to in this Licence, as required by changes in operation and/or technology, and modify the Plans accordingly. Revisions to the Plans are to be submitted in the form of an Addendum to be included with the Annual Report required by Part B, Item 2, complete with a revisions list detailing where significant content changes are made." In its review, CIRNAC was unable to locate a revision list detailing content changes that were made to the updated AEMP. The updated AEMP has significant content changes that reflect changes in operation relative to the previous iteration of the AEMP that was approved by the Board in 2017. The omission of a revision list does not appear to satisfy the requirements of Part B, Item 16. It is also unclear to CIRNAC whether the Licensee has explicitly addressed all comments and commitments made during the regulatory review process. Part I, Item 2 states that: "The Licensee shall, on or before March 31, 2022, submit an updated Aquatic Effects Management Plan for Board approval. The update shall address all comments and commitments made during the regulatory review of the Application and include an adaptive approach to managing nutrients in Goose Lake through an adaptive response framework with action levels to be included in the AEMP. The response framework will inform the need for and the implementation of adaptive mitigation measures. Information on the status of commitments is scattered throughout the document and is sometimes described at a high level. For example, Section 1.2 Scope and Objectives states: “This version of the AEMP was developed in consideration of commitments made during the regulatory review process. A number of these commitments were related to a review and supplementation of the baseline dataset (i.e., historical data collected up to 2016 and supplemental data collected more recently in 2017, 2018, 2021 to 2024); to meet these commitments, an Aquatic Baseline Synthesis Report was developed to report the results of the 2018 AEMP sampling program and evaluate the overall baseline dataset (data up to 2018). The updated AEMP refers to this synthesis report for baseline information. Other commitments were also addressed in this AEMP, specifically

	those made to the NWB and Environment and Climate Change Canada (ECCC) during the regulatory review of the Water Licence application." It is CIRNAC's opinion that a concordance table is needed to clearly demonstrate how the Licensee has addressed all comments and commitments made during the regulatory review process, to satisfy the requirements of Part I, Item 2.
Recommendation	(R-01) CIRNAC recommends that the Licensee provide a revision list for the updated AEMP detailing where significant content changes were made, as per Part B, Item 16, and a concordance table that outlines how all comments and commitments were addressed during the regulatory review process. The concordance table shall include references to applicable sections of document(s) where comments and commitments were addressed.
B2Gold Nunavut Response	The requested concordance table is provided in Appendix A, Table A-1 and Table A-2. A narrative summary of the changes to the AEMP document is provided in Table A-3. A list of changes to the monitoring frequency and design details is provided in Table A-4.

1.3.2 CIRNAC-R-02

Review Comment Number	CIRNAC-R-02
Subject/Topic	Water Quality Predictions
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831
Comment	The Management's Discussion and Analysis, released by B2Gold Corp. dated February 19, 2025, describes the following: "B2Gold successfully completed the 2024 winter ice road ("WIR") campaign in May 2024 and delivered all necessary material from the Marine Laydown Area ("MLA") to complete the construction of the Goose Project in the second quarter of 2025. The mill is now scheduled to start wet commissioning in the second quarter of 2025 with ramp up to full production in the third quarter of 2025." The information provided above appears to suggest that the Project is transitioning into the operations phase in Q2 of 2025, but it is unclear to CIRNAC if this schedule aligns with planned dewatering activities for Umwelt and Llama Lakes, or if there have been any operational changes in the management of this water. For example, the Licensee noted that dewatering would resume during the open water season in 2025 if not completed in 2024, which could overlap with the timing of the operations phase, should it begin in Q2 of 2025. CIRNAC notes that the Licensee shall notify the Board of any changes in Project phases and/or operating plans or conditions associated with the Project at least sixty (60) days prior to any such change, as per Part B, Item 9 of 2AM-BRP1831. The Proponent should not undertake or move forward with a new phase or state without the approval of the Board, including getting approval to carry on any remaining or outstanding tasks from previous phases. Table 2 of the document titled "Back River Project Hydrodynamic and Water Quality Modelling of Goose Lake Report" provides annual average flow rates for all hydrological inputs for model calibration and forecast periods. During the construction forecast period, 1.2 Mm3 year-1 is allocated to the category "Discharge from Water Treatment Plant (WTP) (dewatering of Umwelt and Llama Lakes)", and inflow rates during operations are classified as "not active". CIRNAC notes that changes to dewatering plans could impact water quality predictions and bias future assessments. CIRNAC notes the Licensee appears to suggest some uncertainty in the water quality of Goose Lake in the updated AEMP. For instance, in Section 3.5, the Licensee states: "During the Construction and Operations phases, accumulated surface water runoff and snowmelt in open pits may be discharged to land to allow for mining to continue. This dewatering discharge will be treated to meet MDMER limits (Schedule 4, Table 1) and

	Type A Water licence limits (2AM-BRP1831 Amendment 1 Part F, Items 21 and 22), and discharged to land such that it is expected that the flow will ultimately reach Goose Lake. Although this discharge is expected to be limited in quantity, it is possible that the water quality in Goose Lake will be affected." CIRNAC understands that the Licensee intends to apply discharge criteria to accumulated surface water runoff and snowmelt in open pits. CIRNAC is of the view that this water should be referred to as “contact water” in the AEMP and be considered as contact water in the model, as a conservative approach to avoid underestimating potential impacts of water quality in Goose Lake.
Recommendation	CIRNAC recommends that the Licensee: • Clarify the expected timing of the transition to the operations phase; • Confirm whether any changes have occurred or are planned in the management of water in Umwelt and Llama Lakes intended for discharge into Goose Lake; • Provide a timeline for submitting an updated model to improve predictions of Goose Lake water quality, considering potential changes to dewatering plans and discharge activities.
B2Gold Nunavut Response	Operations phase is not anticipated to commence until the end of August 2025 at the earliest. No changes in management of water in Umwelt and Llama Lakes are intended. An updated water and load balance model will be provided in the 2025 NWB annual report in line with Part E, Item 16 of the license.

1.3.3 CIRNAC-R-03

Review Comment Number	CIRNAC-R-03
Subject/Topic	Aerial Deposition in Aquatic Environments
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831
Comment	Section 3.2 of the AEMP describes stressors of concerns and transport pathways. CIRNAC notes that aerial deposition (e.g., blasting and use of explosives) is not explicitly considered as an interaction pathway in Table 3.2-1 but was included in the previous iteration of the AEMP (2017). The Licensee does not appear to consider aerial deposition in its assessment of potential effects in Goose Lake and Propeller Lake. For example, Section 4.2.3 states: "Effects in Propeller Lake will be assessed in consideration of those identified in Goose Lake (i.e., if there are no Project-related effects in Goose Lake, then no effects would be expected in Propeller Lake located downstream of Goose Lake). Should water quality in Goose Lake indicate the potential for effects in Propeller Lake, then the baseline data collected in Propeller Lake will be reviewed and an appropriate study design will be proposed for this lake." CIRNAC is of the view that, while there is a hydrological connection between Goose Lake and Propeller Lake, aerial deposition could contribute to spatial differences in concentrations in each lake and should be considered a relevant pathway for Project effects on receiving aquatic environments.
Recommendation	CIRNAC recommends that the Licensee: • Update Table 3.2-1 in the AEMP to include aerial deposition as a potential transport pathway; • Confirm if any aerial deposition studies have been conducted and, if so, provide a summary of findings and how they were incorporated into the AEMP; and • If aerial deposition studies have not been completed, assess the potential contribution of aerial deposition to water quality in both lakes, considering spatial variations in contaminant deposition that may not be captured by hydrological connections alone.
B2Gold Nunavut Response	◆ Table 3.2-1 will be updated to add "aerial deposition" to the Interaction Pathway for Explosives. ◆ The Final Environmental Impact Statement determined that the effect from blasting residues on water quality through the aerial deposition pathway was predicted to be negligible due to the mitigation and management measures for explosives use and air quality (Volume 10, Chapters 13 and 17 of the FEIS).

	◆ The potential contribution of aerial deposition of blasting residues to surfaces and the subsequent runoff into Goose Lake will be monitored in the AEMP by the water quality monitoring component. ◆ B2Gold Nunavut has a comprehensive Air Quality Monitoring and Management Plan which includes a fugitive dust reduction plan in order to minimize fugitive dust emissions.

1.3.4 CIRNAC-R-04

Review Comment Number	CIRNAC-R-04
Subject/Topic	Removal of Stream Sampling Locations
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831
Comment	The Licensee noted that stream sampling was removed from this version of the AEMP because (1) water quality monitoring in lakes is sufficient to track changes, and (2) the hydrodynamic model can predict water quality at multiple points in the lake and identify where guidelines and objectives will be met. CIRNAC is of the view that this rationale is not sufficient for justifying the removal of stream sampling. Comparisons of baseline monitoring data is required to confirm the representativeness of water quality in lakes and streams.
Recommendation	CIRNAC recommends that the Licensee conduct a comparative analysis to assess the representativeness of lake and stream water quality data. This analysis shall include both graphical representations and statistical comparisons to determine whether continued stream monitoring is warranted.
B2Gold Nunavut Response	The available data for Goose Lake in the two lake sampling areas closest to the outlet (i.e., Central Basin and Tail) and for Goose Lake outlet show that water quality is similar between the lake and streams during the open-water season. Figures CIRNAC-R-04-1 and CIRNAC-R-04-2 illustrate how field specific conductivity and total dissolved solids vary over the year in two sampling areas within Goose Lake and at the Goose Lake outlet. These two parameters were selected as indicators of ionic strength, which are most likely to show seasonal variability (e.g., lower ionic strength due to snowmelt, higher ionic strength due to mine-related surface runoff). Based on the baseline data, lake water quality is characterized in the proposed AEMP design within the need to include stream monitoring. Please see also responses to KIA-NWB-04 and ECCC-6.

Figure CIRNAC-R-04-1 Field Specific Conductivity in Goose Lake Central Basin, Goose Lake Tail, and the Outlet of Goose Lake, 2011 to 2023

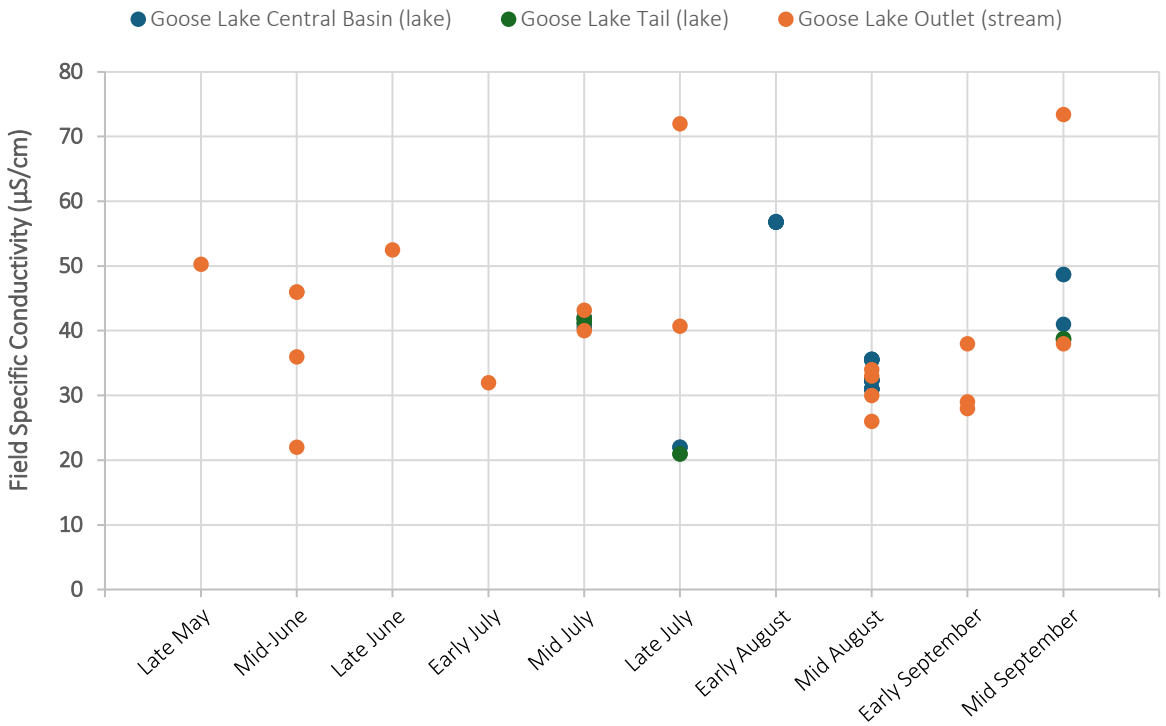
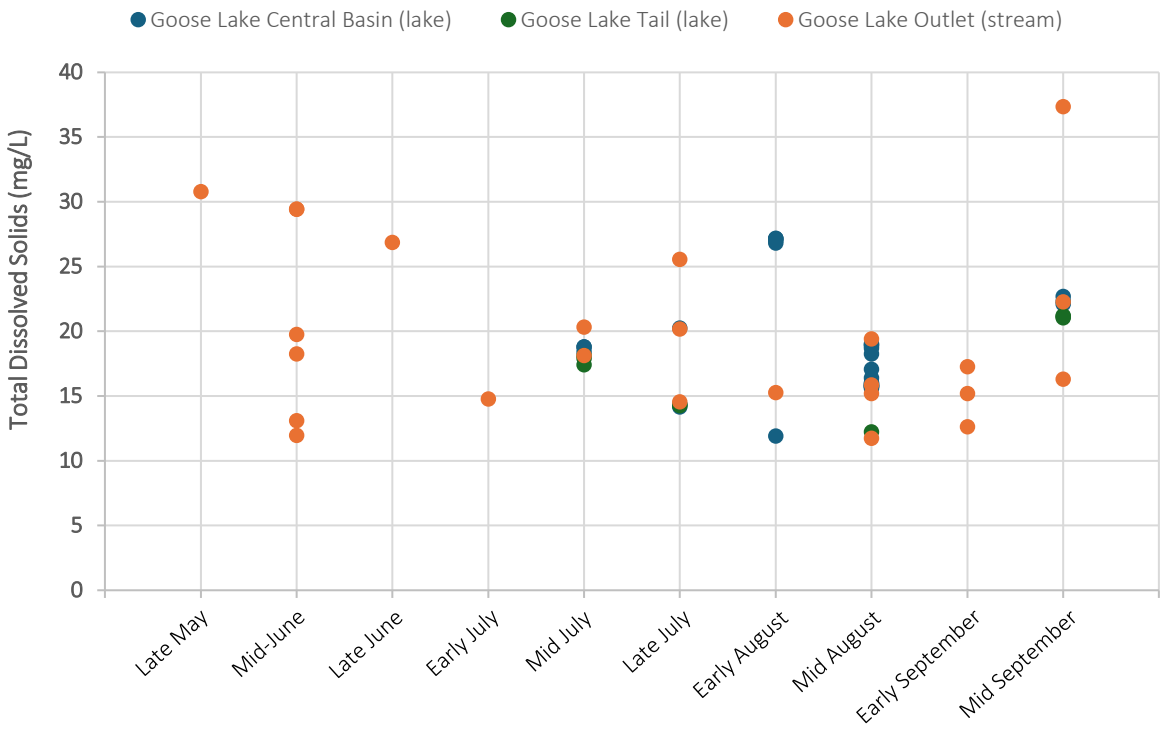


Figure CIRNAC-R-04-2 Total Dissolved Solids Concentrations in Goose Lake Central Basin, Goose Lake Tail, and the Outlet of Goose Lake, 2011 to 2023



Note: Total dissolved solids concentrations were calculated from measured ion concentrations using the Standard Methods formula of APHA (2012).

1.3.5 CIRNAC-R-05

Review Comment Number	CIRNAC-R-05
Subject/Topic	AEMP Benchmarks
References	B2Gold Nunavut Back River Project Aquatic Effects Management Plan for Type A Water Licence No. 2AM-BRP1831.
Detailed Review Comment	Section 5.1.4 of AEMP describes benchmarks that will be used to compare water quality data. The Licensee describes that: "If parameter concentrations naturally exceeded water quality guidelines under baseline conditions, then the AEMP benchmark will be based on the baseline mean plus two standard deviations. When the AEMP benchmark is based on baseline mean plus two standard deviations, a comparison will also be made to water quality guidelines." The Licensee did not provide a justification for using this method. CIRNAC notes that applying this method to a dataset that has high variability (i.e., large standard deviation) would result in a high benchmark. AEMP benchmarks of this nature may trigger exceedances only when very high concentrations are measured.
Recommendation	CIRNAC recommends that the Licensee provide a clear justification for using this method to establish benchmarks.
B2Gold Nunavut Response	After considering site-specific water quality objectives and most recently derived federal environmental quality guidelines, there were no parameters that required the use of an upper bound of baseline concentration to set AEMP benchmarks. See Table ECCC-08-1 for AEMP benchmarks.

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APPENDIX A SUMMARY OF CHANGES TO THE AQUATIC EFFECTS MANAGEMENT PLAN

Table A-1: Concordance of the Aquatic Effects Management Plan with Requirements of the Water Licence (2AM-BRP1831)

Water Licence Requirement	Notes
Part I, Item 2: The Licensee shall, on or before March 31, 2022, submit an updated Aquatic Effects Management Plan for Board approval. The update shall address all comments and commitments made during the regulatory review of the Application and include an adaptive approach to managing nutrients in Goose Lake through an adaptive response framework with action levels to be included in the AEMP. The response framework will inform the need for and the implementation of adaptive mitigation measures.	B2Gold Nunuvut (2024) Aquatic Effects Management Plan, Version 2.0 (December 2024). The adaptive approach to managing nutrients in Goose Lake is described in Section 5.1.4 (Data Analysis and Interpretation) and Table 6.3.1 in Section 6.3 (Action Levels and Significance Thresholds). A summary of required revisions to the AEMP as discussed during the Water Licence application is provided in Table A-2.

Table A-2: Revisions to be Incorporated into the Next Version of the Aquatic Effects Management Plan (AEMP) per WT-ECCC-TC-9 (April 2018)

Revision	Location in the AEMP (Dec 2024 Version)
Correct the description of the trigger for EEM (ECCC-IR-9).	Section 4.1 (Key AEMP Objectives and AEMP Scope)
More description of site water management and in particular effluent discharge from water and load balance (to be provided in First Study Design) (ECCC-IR-10). Indicate that the methodology for the plume delineation study will be discussed further with ECCC to ensure the MMER requirements are met in the First Study Design.	Section 2 (Mine Overview) Section 5.1.4 (Effluent and Water Quality - Data Analysis and Interpretation)
Clarification that that water quality, sediment quality, and benthic invertebrate samples will be collected from specific stations, while fish samples will be collected from broader areas.	Section 4.2 (Study Design Overview) Section 5 (AEMP Study Design Details)
Editorial updates to Tables 4.3-2 and 4.3-3 for consistency in lake trout sampling area (ECCC-IR-14).	Table 4.2-2 in Section 4.2.4 (Sampling Design and Frequency) Section 5.4.2 (Fish - Sampling Approach)
Include water quality analytical detection limit table - see response to ECCC-IR-15.	Section 5.1.3 (Effluent and Water Quality - Field Methods and Laboratory Analysis) Appendix C, Table C-1
Update Table 5.1-1 to include field turbidity, laboratory pH, total dissolved solids (measured and calculated), and fluoride (ECCC-IR-17).	Table 5.1-2 in Section 5.1.2 (Effluent and Water Quality - Sampling Approach)
Outline approach for development of water and sediment quality benchmarks as per response to ECCC-IR-18.	Section 5.1.4 (Effluent and Water Quality - Data Analysis and Interpretation) Section 5.2.4 (Sediment Quality - Data Analysis and Interpretation)
Addition of Total Phosphorus in Sediment quality analyses (ECCC-IR-19).	Table 5.2-1 in Section 5.2.3 (Sediment Quality - Field Methods and Laboratory Analysis)
Identify that sediment sampling be specific to top 1-2 cm of sediment (ECCC-IR-19).	Section 5.2.3 (Sediment Quality - Field Methods and Laboratory Analysis)
Specify particle size methodology - see response to ECCC-IR-19; in 2017 the method used was Pipette removal OM & CO3 (Burt 2009). Historical data files do not have the laboratory certificate of analysis so unable to confirm historical method at this time. However, historical samples were analyzed at ALS and can be confirmed.	Table 5.2-1 in Section 5.2.3 (Sediment Quality - Field Methods and Laboratory Analysis)
Indicate that subsample benthos variability will be characterized in one of the five replicate samples (each consisting of 3 sub-samples) per sampling area lake by not physically pooling the sub-samples for that replicate (ECCC-IR-21).	Section 5.3.3 (Benthic Invertebrate Community - Field Methods and Laboratory Analysis)
Align sampling frequency at BRP-33 with that at BRP-31; periodically review monitoring data and evaluate whether the frequency of water quality sampling is appropriate.	Section 4.2.2 (Sampling Areas) Section 5.1.1 (Effluent and Water Quality - Objectives) Section 6.4 (Plan Effectiveness)
If slimy sculpin habitat is available at BRP-33, relocate slimy sculpin tissue sampling effort from one of the locations in Propeller Lake to BRP-33	Table 4.2-2 in Section 4.2.4 (Sampling Design and Frequency)
Unless otherwise triggered under the MMER or a fish-tissue related effect is observed, reduce frequency of slimy sculpin sampling to once every 6 years to minimize impacts of this sampling.	Section 4.2.4 (Sampling Design and Frequency) Section 5.4 (Fish)
Include details of benthic invertebrate statistical tests described in response to ECCC-IR-22.	Section 5.3.4 (Benthic Invertebrate Community - Data Analysis and Interpretation)

Revision	Location in the AEMP (Dec 2024 Version)
Include details of statistical tests, as described in response to ECCC IR 18.	Section 4.2.3 (Statistical Design) Section 5.1.4 (Effluent and Water Quality - Data Analysis and Interpretation) Section 5.2.4 (Sediment Quality - Data Analysis and Interpretation) Section 5.3.4 (Benthic Invertebrate Community - Data Analysis and Interpretation) Section 5.4.4 (Fish - Data Analysis and Interpretation)
Sabina will update the QA/QC Plan (171005 2AM-BRP----SD24-QAQCPlan-IMLE) to include a discussion on data quality objectives (e.g., steps to review and validate data from duplicates, blanks, and samples) (ECCC-IR-27).	The QA/QC Plan is a separate document from the AEMP.
Indicate that biological sampling (including fish) will commence a year after the initiation of discharge (i.e., year one of the First Biological Monitoring Study) if in alignment with MMER requirements, to harmonize MMER requirements with KIA request.	Section 4.2.4 (Sampling Design and Frequency)

Notes: List of revisions as agreed between Sabina Gold & Silver Corp and Environment and Climate Change Canada in April 2018. Commitments made to revise the AEMP as discussed during the regulatory review of the Water Licence application

Table A-3: Overview of Changes to the Aquatic Effects Management Plan (AEMP) from the Previous Version

AEMP Section	Overall Summary of Changes
Sections 1 and 2 (Introduction and Mine Overview)	Text was re-arranged and updated with current information on the Project and regulatory history of the AEMP. Additional description of water management on site was also provided to address ECCC request (see Table A-2).
Section 3 (Conceptual Site Model)	Text was revised to improve clarity of presentation and better reflect the current understanding of the Project. Aerial deposition of blasting residues directly to Goose Lake was missed in Section 3.2 and will be added to the next update of the AEMP. A high-level summary of the expected changes to water quality during each phase of the Project was added (Section 3.5) to support the reader's understanding of the monitoring design in Section 4.
Section 4 (Aquatic Effects Management Plan Overview)	Text was updated based on the current understanding of the Project including the key findings of the Aquatic Baseline Synthesis Report, results of baseline data collection since the October 2017 version of the AEMP, and modifications to the Project description according to the 2019 Modification Package. This section was also updated with more information about the study lakes and descriptions of the exposure areas as they vary during the Project life. This section also provided more explanation on the statistical design for the AEMP. As stated in Section 1.2 of the AEMP, the AEMP is a living document that will be updated, as necessary, based on regulatory changes, Project-related changes, incident investigations, the need for changes to existing mitigation measures, and input from regulators and the KIA.
Section 5 (AEMP Study Design Details)	More details were added to this section on methods of field data collection and data analysis and interpretation for each monitoring component. The text on quality assurance and quality control was also expanded. Section 5.4.6 (Fish and Fish Habitat Protection from Blasting) was removed from Section 5.4 (Fish) as the text was not relevant to the AEMP study design.
Section 6 (Adaptive Management Response Framework)	Text was updated to incorporate updated guidance on the development of Response Frameworks. The significance thresholds were explicitly stated, and the Low Action Level criteria were refined based on the monitoring study design and to address the Water Licence requirement with regards to adaptive approach to managing nutrients in Goose Lake.
Section 7 (Environmental Reporting)	Section 7.1 (Annual AEMP Report) was revised to provide more clarity on the timing and content of the AEMP report. Section 7.2 (Reports upon the MDMER) text was updated in consideration of changes to the Metal and Diamond Mining Effluent Regulations (MDMER). In addition, more clarity was provided as to timing and content of reports required for the MDMER EEM, and how the AEMP contributes to those reports.
Section 8 (References)	Text was updated as appropriate.
Appendix A	Appendix was added to reference the Aquatic Baseline Synthesis Report, which was submitted to Nunavut Water Board (NWB) in September 2020, and approved by the board in November 2020.
Appendix B	Appendix was added to provide the requested target detection limits for the AEMP chemistry-related monitoring components as requested by ECCC (see Table A-2).

Table A-4: Changes to the Monitoring Frequency and Design in the Updated AEMP Compared to the October 2017 Version

Category	Change	Rationale
Sampling Area	A new sampling area in Goose Lake identified: West Bay at Goose Lake Inflow	West Bay at Goose Lake Inflow sampling area was added to evaluate dewatering discharge during Construction period, and pit overflow in Closure period.
Sampling Frequency	Not all sampling areas are sampled every year for every monitoring component	It is not necessary to sample several different areas in Goose Lake at every sampling event. Instead, exposure areas will be sampled as appropriate to the Project phase and the expected influence on the aquatic receiving environment. For example, during dewatering, the West Bay at Goose Lake Inflow sampling area is the area of the lake most likely to have the highest concentration of dewatering discharge and thus should sampled during Construction period. If Echo Pit dewatering occurs, then the West Bay at Echo Outflow would be the most relevant sampling area to evaluate the influence of that discharge on Goose Lake. At closure, pit overflow will occur, which will have the greatest influence on water quality at the West Bay at Goose Lake Inflow and Southeast Basin sampling areas. B2Gold Nunavut also committed to collecting supplemental information in Propeller Lake at least three years prior to the initiation of pit overflow (at this time, Southeast Basin will be initiated as well). In every year of the AEMP (regardless of whether there is discharge), the Central Basin sampling area will be monitored for water quality, which will provide measurements of Goose Lake water quality over time.
	Every six years for fish tissue	Text was revised as discussed with ECCC (Table A-2).

Category	Change	Rationale
Water Quality	Details about effluent characterization removed	Effluent sampling is not part of the AEMP, but rather part of the Water Management Plan and the Dewatering Plan, which provide details of effluent sampling and analysis.
	Lake outlet stations (three: Goose Lake Outlet, Propeller Lake Outlet, Reference B Lake Outlet) removed from the AEMP	Water quality monitoring in lakes is sufficient to track changes in water quality due to the Project, and to characterize water quality entering downstream waterbodies. Previous versions of the AEMP selected stream sampling stations to be similar to the locations modelled in the water quality model and assumed that these stations could be used as compliance points. In the updated water quality model for the Project, the hydrodynamic model can predict water quality at multiple locations within the lake, and can identify where in the lake water quality guidelines and objectives will be met. Thus, monitoring at lake stations will be sufficient to evaluate the accuracy of the Project effect predictions.
	Specified at what point in the Project life that a specific exposure area in Goose Lake would be sampled	It is not necessary to sample several different areas in Goose Lake at every water quality sampling event. Instead, exposure areas will be sampled as appropriate to the Project phase and the expected influence on the aquatic receiving environment. For example, during dewatering, the West Bay at Goose Lake Inflow sampling area is the area of the lake most likely to have the highest concentration of dewatering discharge and thus should sampled during Construction period. If Echo Pit dewatering occurs, then the West Bay at Echo Outflow would be the most relevant sampling area to evaluate the influence of that discharge on Goose Lake. At closure, pit overflow will occur, which will have the greatest influence on water quality at the West Bay at Goose Lake Inflow and Southeast Basin sampling areas. B2Gold Nunavut committed to collecting supplemental information in Propeller Lake at least three years prior to the initiation of pit overflow (at this time, Southeast Basin will be initiated as well). In every year of the AEMP, the Central Basin sampling area will be monitored, to provide consistent measurements of Goose Lake water quality over time.
	Months when water quality sampling occurs: April (under-ice) and August (open-water), as well as in July when there is a Lake Trout survey, and in April, July, August, and September when there is effluent discharge to Goose Lake	The timing of water quality sampling is dependent on the Project activities that can influence the aquatic environment. If the Project is subject to the MDMER, then water quality monitoring must occur quarterly during periods of discharge.
	Lake water samples changed to be collected at 1 m below the water or ice surface (instead of mid-depth). For stations greater than 6 m, an additional sample will be collected at mid-depth.	Sampling depth was revised to be consistent with baseline sampling methods. Note that all stations have a maximum water depth of 5 m, and stratification has not been observed at the AEMP sampling stations.
	Analytical suite updated	Parameters were added as discussed with ECCC (Table A-2). Clarified that chlorophyll *a* will be analyzed during the open-water sampling events only.
	Target detection limits added	These details were added as discussed with ECCC (Table A-2).
	Methods of data analysis and interpretation expanded	These details were missing from the previous AEMP.
	Methods for describing effluent mixing in the receiving environment added	Text was revised as discussed with ECCC (Table A-2).
	Additional description of quality assurance and quality control added	These details were missing from the previous AEMP.

Category	Change	Rationale
Sediment Quality	Sediment samples collected from top 2 cm of sediment	Text was revised as discussed with ECCC (Table A-2).
	Analytical suite updated	Total phosphorus added as discussed with ECCC (Table A-2). In addition, moisture content and total nitrogen added to provide additional information.
	Analytical method for particle size clarified	Text was revised as discussed with ECCC (Table A-2).
	Target detection limits added	These details were added as discussed with ECCC (Table A-2).
	Methods of data analysis and interpretation expanded	These details were missing from the previous AEMP.
	Additional description of quality assurance and quality control added	These details were missing from the previous AEMP.
Benthic Invertebrate Community	Biological monitoring to occur in the first year after dewatering discharge	B2Gold Back River Corp. committed to ECCC and KIA to initiate biological monitoring studies in the year after dewatering discharge.
	At one station per sampling area, three individual grab samples will be preserved, processed, and identified separately, to provide an indication of within-station variability and verify adequacy of three subsamples per composite sample. Once within-station variability is established, this will be discontinued and five composite samples will be collected within each area for processing and taxonomic identification.	Additional sampling was added as discussed with ECCC (Table A-2).
	Methods of data analysis and interpretation expanded	These details were missing from the previous AEMP.
Fish Health and Tissue Chemistry	Biological monitoring to occur in the first year after dewatering discharge	B2Gold Back River Corp. committed to ECCC and KIA to initiate biological monitoring studies in the year after dewatering discharge.
	Biological monitoring may not occur if there has been no discharge in the proceeding three years	Similar to the MDMER EEM requirements, biological monitoring is not expected to be conducted when there has been no effluent discharge to Goose Lake in the 36 months previous to the last biological monitoring study.
	Water quality, sediment quality, and benthic invertebrate community samples will be collected from specific stations whereas fish will be collected from broader areas.	Text was revised as discussed with ECCC (Table A-2).
	Fish to be monitored initially in Goose Lake and Reference B Lake, with monitoring in Propeller Lake to occur later in the Operations phase, prior to initiation of pit overflow	Effects on Propeller Lake water quality are not expected, if at all, until after pit overflow to Goose Lake starts in Closure period. It is not necessary to conduct fish sampling in Propeller Lake in during Construction and early Operations phases, unless water quality monitoring indicates a need to move monitoring farther downstream.
	First small-bodied fish survey to focus on the exposure area where discharge is expected to have the greatest influence	The fish health survey will focus on the exposure area with greatest discharge concentrations, consistent with Metal Mining EEM guidance.
	Methods of data analysis and interpretation expanded	These details were missing from the previous AEMP.