MEMORANDUM
File: PE-110652

Date: March 30, 2023

To: Neil Bailey, Authorizations Section Head, Mining Operations, Ministry of Environment and Climate Change Strategy (ENV)

From: Andrew Foster, Environmental Impact Assessment Biologist, Mining Operations, ENV
Kristy Wade, Environmental Impact Assessment Section Head, Mining Operations, ENV

RE: Proposed BW Gold Blackwater Mine Science Based Environmental Benchmark (SBEB) for Aluminum dated November 2022.

This memo reviews the *Blackwater Gold Project Dissolved Aluminum Science Based Environmental Benchmark Submission Summary* and provides recommendations for aluminum SBEBs in Davidson Creek.

Conclusions:

- The proposed Science Based Environmental Benchmarks (SBEBs) were appropriately derived using the background approach and represent protective thresholds.
- Spatial boundaries for SBEBs in Lower Davidson Creek (i.e., between WQ26 and WQ7, Reaches C and D) were not finalized in the SBEB submission.
- Aluminum BC WQG for aquatic life will apply January 1st – March 31 (no SBEB proposed).
- SBEBs are not limits or standards in and of themselves, however they must be used as target benchmarks in annual water quality and Aquatic Effects Monitoring Program (AEMP) reports.

Recommendations regarding BW Gold proposed aluminum SBEB:

I recommend:

- The downstream end of Reach C of Davidson Creek (which is also the upstream end of Reach D) be just upstream of the confluence with Tributary 226858, until and unless additional data and analysis support a different location and an update is accepted by ENV.
- The reach-specific aluminum SBEB values should not be exceeded in more than one sample in any given year.

Background

Blackwater Mine is a proposed gold and silver open pit mine located 160km southwest of Prince George, B.C to be operated by Blackwater Gold (BW Gold). The proposed mine site is located in the traditional territories of Ulkatcho First Nation (UFN), Lhoosk'uz Dene Nation (LDN), Skin Tyee Nation (STN) and Tsilhqot'in Nation (TN). The mine is in proximity to several fish bearing waterbodies including, Davidson, Turtle, Chedakuz and 661 Creeks. The original joint *Mines Act* (MA) and *Environmental Management Act* (EMA) application was submitted in November 2021 for screening, revised, and resubmitted for review in March 2022. Condition 26 of the Environmental Assessment Certificate for the mine stipulated that the holder, must ensure **the Project does not cause** downstream water quality to exceed BC Water Quality Guidelines (WQG) or ENV accepted SBEBs (EAO, 2019).

Baseline data provides evidence that dissolved aluminum (d-Al) naturally exceeds BC WQGs in Davidson Creek, Creek 661, and Creek 661 tributaries. To address this, BW Gold submitted a SBEB development plan and proposed SBEB values with their 2021 EMA permit application. ENV agreed BW Gold could submit the SBEB development plan and proposed SBEBs as a single submission given the straightforward nature of the SBEB being proposed (i.e., Background Concentration Procedure) but identified that this

approach risked delays and potential method alterations upon review. The proposed SBEBs were revised during EMA review to address ENV review comments. In review, ENV identified that there was limited baseline data in Creek 661 tributaries and BW Gold withdrew their application for a surface discharge to a Creek 661 tributary. BW Gold has subsequently indicated they may propose SBEBs for Creek 661 and Creek 661 tributaries with a future EMA application to discharge to a Creek 661 tributary.

SBEB Methods

The proposed SBEBs followed ENV's "Background Concentration Procedure" (i.e., 95th percentile plus 20%) to derive station specific dissolved Al SBEB on Davidson Creek:

1. Aluminum data split into periods of freshet (April 1-July 31) and summer (August 1-December 31)
    a. Note: No SBEB proposed January 1-March 31
2. Site specific 95th percentile calculated using baseline data from April 2011 to July 2022
3. 20% of site specific 95th percentile value added to 95th percentile to create SBEB values
4. SBEBs proposed for defined reaches
5. Confirmed drinking water guideline not exceeded

By applying SBEBs using a reach-based approach **additional** water quality stations can be established that can meet EAC condition 26 (Lorax, 2022). Without a reach approach any new stations would have insufficient unimpacted baseline data for SBEB development using the background method.

Background Concentration Procedure

In the background concentration procedure, the 95th percentile for a given station is used to represent the upper limit of background concentrations (ENV, 2013). Further, a change of 20% from current conditions (95th percentile) is considered to be "no change" and therefore represent a protective threshold (ENV, 2013). Twenty percent was rationalized as natural variability is often greater than 20% and the precision of measurement of low concentration metals in replicate samples is not usually better than 20% in ideal laboratory conditions (ENV, 2013).

SBEB Results

Site specific calculated SBEBs for each station on Davidson Creek are broken down by time period (Table 1). These site specific SBEBs represent new benchmarks for comparison in lieu of aluminum BC WQG for the protection of aquatic life. These benchmarks are applicable for use in annual reports, the Aquatics Effects Monitoring Plan (AEMP) reports, and for Trigger Response Plans (TRPs). **The proposed benchmarks for the protection of aquatic life are well below BC WQGs for drinking water (9.5 mg/L), agricultural irrigation and livestock use (5mg/L), and wildlife (5mg/L)**.

Table 1. 95th Percentile + 20% concentrations of dissolved aluminum (mg/L) for Davidson Creek stations using baseline dataset April 2011 to July 2022 (Lorax, 2022)

Data period	Proposed Al SBEB (95th percentile + 20% based on baseline data) in mg/L			
	WQ28 (Reach A)	WQ27 (Reach B)	WQ26 (Reach C)	WQ7 (Reach D)
April 1 – July 31	0.28	0.26	0.25	0.23
August 1 – December 31	0.13	0.11	0.090	0.079

The SBEBs were proposed to apply within reaches (Lorax, 2022; Appendix 1):

- Reach A (WQ28 SBEB applies): Below the Freshwater Reservoir discharge to approximately halfway between WQ28 and WQ27;
- Reach B (WQ27 SBEB applies): Halfway between WQ28 and WQ27, to approximately halfway between WQ27 and WQ26;
- Reach C (WQ26 SBEB applies): Approximately halfway between WQ27 and WQ26 to either:
    - a. Immediately upstream of the Tributary 226858 catchment discharge to Davidson Creek, **or**
    - b. Immediately upstream of the Tributary 114028 catchment discharge to Davidson Creek.
- Reach D (WQ7 SBEB applies): Below the WQ26 SBEB area to the Davidson Creek confluence with Chedakuz Creek.

Tributaries 226858 and 114028 represent substantial catchment sizes and, therefore, flow contributions to Davidson Creek (Lorax, 2022) that could alter Davidson Creek mainstem aluminum concentrations. There is uncertainty where Reach C should end and where Reach D should begin as no sampling was conducted in this section.

ENV Review:

I reviewed BW Gold's methods and determined the background concentration procedure was followed in the creation of SBEB. These benchmarks must be used in monitoring, annual reporting, and AEMP reporting. Ongoing AEMP and water quality monitoring can support SBEB applicability and verify SBEB protectiveness.

Defining the spatial boundaries of Reach C using the first option (a) proposed by Lorax provides greater protection of aquatic receptors until more data is collected. Notably, the percent difference between sites WQ26 and WQ7 is relatively low, 8 and 12% for April to July and August to December periods respectively (Table 2). This supports that option (a) is reasonable and that there is low risk from exceeding concentrations downstream of Tributary 226858. The proposed SBEBs are site specific and although a reach approach was used, these benchmarks are most applicable at the specific site. There is inherent uncertainty when applying SBEBs across the entirety of a given reach; option (a) reduces this uncertainty.

Table 2: Percent difference between site specific SBEBs.

	Percent Difference Between Sites (%)		
Data period	WQ 28/27	WQ 27/26	WQ 26/WQ7
April 1 – July 31	7%	4%	8%
August 1 – December 31	15%	18%	12%

Despite being set at the 95th percentile + 20% of the baseline dataset, single sample exceedances may occur. Lorax (2022) noted that select datapoints in the WQ28, WQ27, and WQ7 baseline datasets exceeded the proposed SBEB during the high flow season. An early freshet could cause an exceedance of the aluminum BC WQG outside the requested SBEB time window (January 1st-March 31st). In addition, climate change (e.g., precipitation decrease) could shift natural background aluminum concentrations and alter baseline conditions.

The SBEB values are 95th percentiles (+20%) calculated from a dataset of largely single samples collected once per month. Over the entire period of record for the background dataset, the SBEBs values were never exceeded more than once per time period per year (i.e. Apr-Jul and Aug-Dec are the two SBEB time

periods). Therefore, when using the SBEB thresholds in the future, we could reasonably assume background conditions and environmental protection will be maintained if no more than one sample exceeds the (time and reach-based) SBEB value in any single year.

Recommendations regarding BW Gold proposed aluminum SBEB:

I recommend:

- The SBEBs be accepted as proposed, with the condition that the downstream end of Reach C (which is also the upstream end of Reach D) is just upstream of Tributary 226858 until additional data and analysis support a different location and an update is accepted by ENV.
- ENV accept the proposed reach-specific aluminum SBEB values and they should not be exceeded in more than one sample in any single year where the SBEB values are greater than the d-Al acute BC WQG. Where SBEB values are less than the acute d-Al BC WQG (i.e., Reach 3 and 4 from August 1st to December 31st) the 30-day mean of samples should not exceed the reach-specific SBEB.

Conclusion:

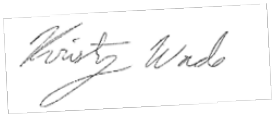
Overall revisions to the proposed Davidson Creek SBEBs during review were adequate and addressed my concerns regarding SBEB applicability. I have provided my opinion and recommendations regarding setting an aluminum SBEB in Davidson Creek with conditions regarding the spatial application of SBEB concentrations and a limit to the expected frequency of exceedance. SBEBs must be used as benchmarks in annual water quality and Aquatic Effects Monitoring Program (AEMP) reports.

I trust that these comments and recommendations will be useful when evaluating the BW Gold's Blackwater mine proposed aluminum SBEBs and considering ENV acceptance of the benchmarks. If you have any questions or concerns regarding the content of this memo, please don't hesitate to contact me at either Andrew.Foster@gov.bc.ca or 778-362-4604.

Sincerely,

Andrew Foster, R.P. Bio
Environmental Impact Assessment Biologist, Mining Operations
Ministry of Environment and Climate Change Strategy

I have reviewed this memo and conclusions and accept the SBEB with the recommended conditions.



Kristy Wade, R.P. Bio
EIA Section Head – Mining
Ministry of Environment and Climate Change Strategy

Literature Cited

[ENV] British Columbia Ministry of Environment. (2013). *Guidance for the Derivation and Application of Water Quality Objectives in British Columbia*. Water Protection and Sustainability Branch.

[EAO] Environmental Assessment Office. (2019). Schedule B Table of Conditions for An Environmental Assessment Certificate.https://projects.eao.gov.bc.ca/api/public/document/5d1109e92eab980021ee1ed5/download/Blackwater%20-%20Schedule%20B%20Table%20of%20Conditions.pdf

[Lorax] Lorax Environmental Service Ltd. (2022). *Blackwater Gold Project Dissolved Aluminum Science Based Environmental Benchmark Submission Summary*. Prepared for BW Gold Ltd. November 30, 2022.

Appendix 1 – Proposed Reaches in Davidson Creek at Which Derived Station-Specific SBEBs Apply (Lorax, 2022)

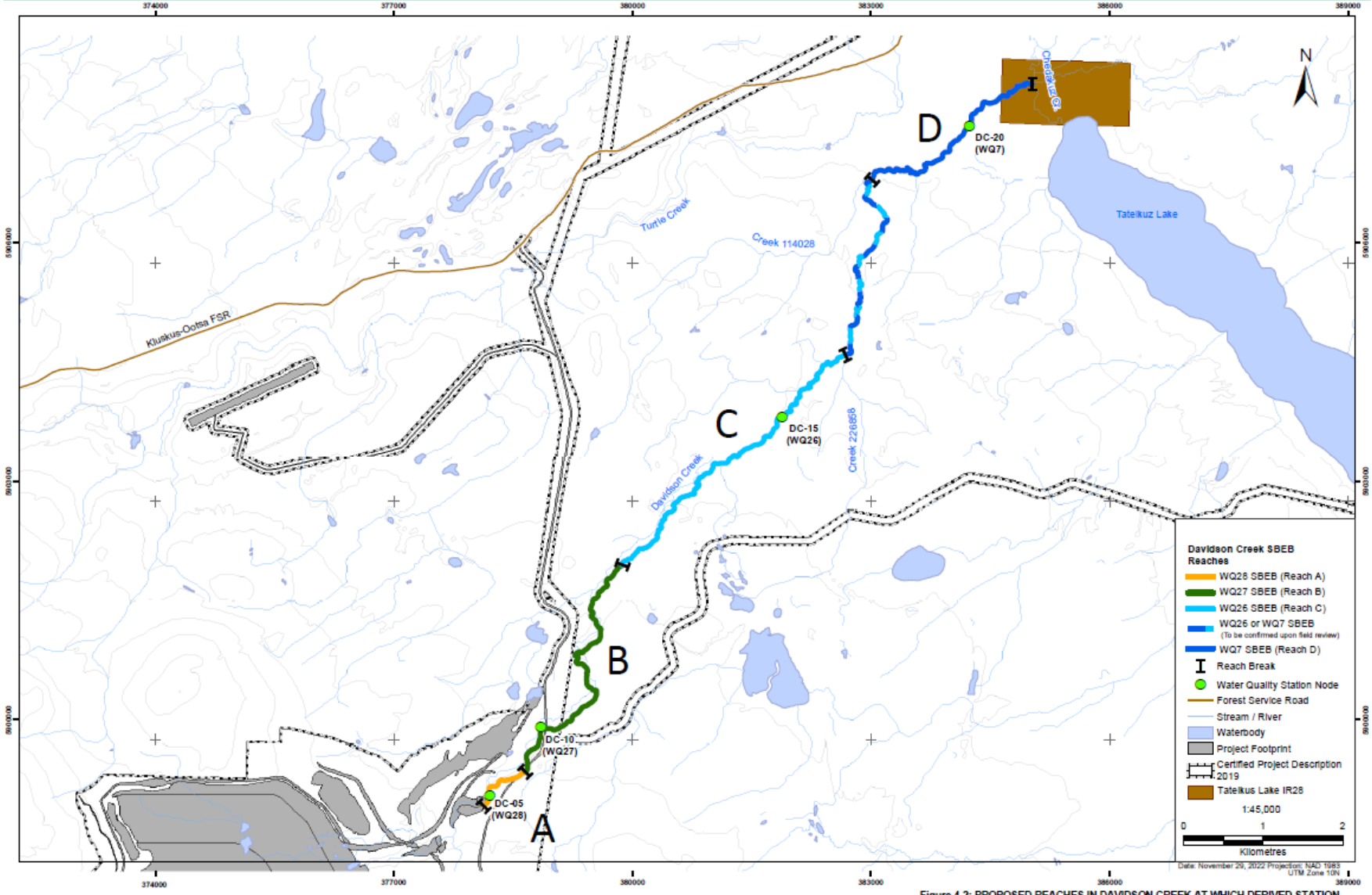


Figure 4-2: PROPOSED REACHES IN DAVIDSON CREEK AT WHICH DERIVED STATION-SPECIFIC SBEBS APPLY

Appendix 2 – Locations of Proposed SBEB Reaches in Davidson Creek (Adapted from Lorax, 2022)

Reach	Reach Description	Start UTM (10U)	End UTM (10U)	Al SBEB (mg/L) Apr 1 – Jul 31	Al SBEB (mg/L) Aug 1 – Dec 31
A (WQ28/ DC-05)	Freshwater Reservoir to roughly midway between WQ28 and WQ27	378129mE 5899165mN	378654mE 5899595mN	0.28	0.13
B (WQ27/ DC-10)	Roughly midway between WQ28 and WQ27 to roughly midway between WQ27 and WQ26	378654mE 5899595mN	379873mE 5902196mN	0.26	0.11
C (WQ26/ DC-15)	Roughly midway between WQ27 and WQ26 to immediately upstream of the Tributary 226868 confluence with Davidson Creek	379873mE 5902196mN	382674mE 5904839mN	0.25	0.090
D (WQ7/DC-20)	Immediately upstream of the Tributary 226868 to Davidson Creek confluence with Chedakuz Creek	382674mE 5904839mN	385025mE 5908246mN	0.23	0.079